

## A REVIEW OF SOME AUSTRALASIAN CHERNETIDAE: *SUNDOCHERNES*, *TROGLOCHERNES* AND A NEW GENUS (PSEUDOSCORPIONES)

**Mark S. Harvey:** Department of Terrestrial Invertebrates, Western Australian Museum, Locked Bag 49, Welshpool DC, Western Australia 6986, Australia.  
E-mail: mark.harvey@museum.wa.gov.au

**Erich S. Volschenk:** Department of Zoology, James Cook University, Townsville, Queensland 4811, Australia. Current address: Department of Terrestrial Invertebrates, Western Australian Museum, Locked Bag 49, Welshpool DC, Western Australia 6986, Australia

**ABSTRACT.** A systematic review of some Australasian species previously allocated to the chernetid genus *Sundochernes* Beier 1932 reveals numerous discrepancies from the type species, *S. modiglianii* (Ellingsen 1911). Three of these species are removed to the genus *Troglochernes* Beier 1969, previously known from only a single troglobitic species, and a fourth is removed to a new genus. *Troglochernes* contains six species: the type species *T. imitans* Beier 1969 from caves on the Nullarbor Plain, Western Australia; three species newly transferred from *Sundochernes*, *T. guanophilus* (Beier 1967) new combination, from Fig Tree Cave, New South Wales, *T. dewae* (Beier 1967) new combination, from bird nests in New South Wales, Queensland and Western Australia, *T. novaeguineae* (Beier 1965) new combination, from central Papua New Guinea; and two new species, *T. cruciatus* Volschenk, new species from Rope Ladder Cave, North East Queensland and *T. omorgus* Harvey & Volschenk, new species from a beetle in Queensland. The Lord Howe Island endemic pseudoscorpion *Sundochernes grayi* Beier 1975 is transferred to a new genus, *Satrapanus* Harvey & Volschenk, as it lacks the diagnostic features of *Sundochernes*. Problems with the generic allocation of species currently placed within *Sundochernes* are discussed and the female genitalia of *Nesochernes gracilis* Beier 1932 and *Paraustrochernes victorianus* Beier 1966 are illustrated for the first time. *Troglochernes imitans* is one of the most highly modified troglobitic members of the Chernetidae, displaying extremely elongate pedipalps and legs suggesting an extended period of isolation from ancestral epigeal populations. The remaining cave-dwelling species, *T. cruciatus* and *T. guanophilus*, are less modified and show fewer morphological modifications which may suggest more recent colonization of the cave environments.

**Keywords:** Taxonomy, morphology, new species, *Nesochernes*, caves, bird nests

The Australasian chernetid fauna is moderately well developed, with representatives of 36 genera currently described. Few genera, however, contain more than a handful of species, and many are inadequately defined with crucial details, such as the internal female genitalia, often unknown. The genus *Sundochernes* Beier 1932 is one of the larger genera of the region with 10 named species ranging from tropical south-eastern Asia to temperate southern Australia. A further species, doubtfully referred to the genus, was named from Brazil (Beier 1974a). The type species *Chelififer modiglianii* Ellingsen 1911 was originally named from specimens collected in Sumatra (Ellingsen 1911), and later recorded from Ma-

laysia (Beier 1967a). It was briefly redescribed, and illustrated for the first time, by Beier (1932). Our examination of the syntypes revealed that some species attributed to *Sundochernes* were clearly not congeneric with *S. modiglianii*. The study presented here demonstrates that four species originally attributed to *Sundochernes* lack the diagnostic features of that genus, and alternative taxonomic arrangements should be sought. Through the study of a range of specimens of *Troglochernes imitans* Beier 1969, we have been able to ascertain that three of these species, along with two other newly described Australian species, can be attributed to *Troglochernes* Beier 1969 rather than *Sundochernes*. We

have also been able to demonstrate that *Sundochernes grayi* Beier 1976 belongs to a separate genus, here named *Satrapanus*, largely based upon the distinctive morphology of the female internal genitalia. The morphology of the spermathecae, which has been shown to be of significant value at the generic level within the Chernetidae (e.g., Vachon 1938; Muchmore 1974, 1975; Mahnert 1978), provides support for the recognition of distinct genera.

## METHODS

The specimens examined for this study are lodged in the following institutions: Australian Museum, Sydney, Australia (AM); American Museum of Natural History, New York, USA (AMNH); Australian National Insect Collection, Canberra, Australia (ANIC); Museum of Natural History, London, UK (BMNH); Bishop Museum, Honolulu, Hawaii, USA (BPBM); Field Museum of Natural History, Chicago, Illinois, USA (FMNH); Museo Civico di Storia Naturale "Giacomo Doria," Genova, Italy (MCSNG); Muséum d'Histoire Naturelle, Genève, Switzerland (MHNG); Muséum National d'Histoire Naturelle, Paris (MNHN); Museum of Tropical Queensland, Townsville, Australia (MTQ); Naturhistorisches Museum, Wien, Austria (NHMW); Museum Victoria, Melbourne, Australia (NMV); Queensland Museum, Brisbane, Australia (QM); South Australian Museum, Adelaide, Australia (SAM); United States National Museum, Smithsonian Institution, Washington, DC, USA (USNM); Western Australian Museum, Perth, Australia (WAM); and Universitets Lund, Lund, Sweden (ZMLU). Some specimens of *Satrapanus grayi* were collected by staff from the Australian Museum's Centre for Biodiversity and Conservation Research, abbreviated to CBCR.

In addition to the specimens detailed below, we also examined the internal genitalia of females of two Australasian chernetids. *Nesochernes gracilis norfolkensis* Beier 1976: 2 males, 2 females, 1 tritonymph, 1 deutonymph, 1 protonymph from Filmy Fern Walk, 29°01'S, 167°57'E, Norfolk Island National Park, Norfolk Island, Australia, 30 November 1984, litter under *Araucaria heterophylla*, T.A. Weir (WAM T68620). *Paraustrochernes victorianus* Beier 1966: 1 female from Cumberland Falls, Victoria, Australia, 37°34'S,

145°53'E, 27 May 1991, under bark of *Eucalyptus regnans*, M.S. Harvey & M.E. Blosfelds (WAM T66536).

Terminology and mensuration mostly follows Chamberlin (1931), with the exception of the nomenclature of the pedipalps and legs, and with some minor modifications to the terminology of the trichobothria (Harvey 1992b). The specimens were studied using three techniques. Temporary slide mounts were prepared by immersion of specimens in concentrated lactic acid at room temperature for several days, and mounting them on microscope slides with 10 or 12 mm coverslips supported by small sections of 0.25, 0.35 or 0.50 mm diameter nylon fishing line or with small slivers of broken coverslips. After study, the specimens were returned to 75% ethanol with the dissected portions placed in 12 x 3 mm glass genitalia microvials (BioQuip Products, Inc.). Permanent slide mounts were prepared by removing the pedipalps, the chelicera, left leg I, and left leg IV from specimens with the use of eye-scissors or small needles, and clearing overnight with 10% potassium hydroxide at room temperature. The specimens were then washed in several rinses of water and 5% acetic acid (to neutralise the potassium hydroxide), and dehydrated through a graded ethanol series. They were then transferred to Euparal Essence overnight at room temperature, prior to mounting in Euparal on microscope slides using 10 or 12 mm coverslips supported by small sections of 0.25, 0.35 or 0.50 mm diameter nylon fishing line. All specimens were studied using an Olympus BH-2 compound microscope and illustrated with the aid of a drawing tube. Measurements were taken at the highest possible magnification using an ocular graticule.

The maps were produced with the computer program ArcView 3.2 after the relevant locality data were stored in an Access database. Coordinates were obtained from various sources, including the Geoscience Australia Place Names Search website (<http://www.ga.gov.au/maps/names>) and the GeoNet Names Server (<http://earth-info.nga.mil/gns/html/>) produced by the National Geospatial-Intelligence Agency. Recently collected specimens were usually provided with GPS coordinates taken at the collecting site. Coordinates obtained from indirect sources (such as gazetteers) are listed below within parentheses.



FAMILY CHERNETIDAE MENGE 1855  
SUBFAMILY CHERNETINAE  
MENGE 1855

Genus *Sundochernes* Beier 1932

*Sundochernes* Beier 1932:162; Beier 1933:531;  
Beier 1976:225; Harvey 1991:635.

**Type species.**—*Chelifer modiglianii* Ellingsen 1911, by original designation.

**Type material.**—*Sundochernes modiglianii* (Ellingsen 1911): Syntypes: 1 male, 7 females, 1 nymph, Sirambas (as Si-Rambé), Sumatra, Indonesia [0°49'N, 99°32'E], no date, E. Modigliani (MCSNG), examined.

*Sundochernes australiensis* Beier 1954b: Holotype female, Denmark, near mouth of Denmark River, Western Australia, Australia [34°58'N, 117°22'E], karri [*Eucalyptus diversicolor*] forest, 26 January 1952, T. Gislén (ZMLU), not examined.

*Sundochernes brasiliensis* Beier 1974a: Holotype male, Nova Teutônia, Santa Catarina, Brazil [27°03'S, 52°24'W], 300–500 m, F. Plaumann (MHNG), examined.

*Sundochernes dubius* Beier 1954b: Holotype female, Augusta, Western Australia, Australia [34°19'S, 115°09'E], 12 December 1952, T. Gislén (ZMLU), not examined.

*Sundochernes gressitti* Beier 1957: Holotype female, Ngaremeskang, Babelthuap, Palau [07°31'N, 134°33'E], 30 m, 21 December 1952, J. L. Gressitt (USNM 2262), examined. Paratype: 1 female, Ngercheu Islands [as Garakayo Island], "Pelew" Islands [= Palau] [07°05'N, 134°16'E], 8 August 1945, H. S. Dybas (FMNH), examined.

*Sundochernes malayanus* Beier 1963: Holotype male, Rantau Panjang, 5 mi N of Klang, Selangor, Malayasia [03°25'N, 101°28'E], from nest of Olive Bulbul, *Microcelus olivacea*, 28 June 1961 (BPBM), examined. Paratype: 1 tritonymph, same data as holotype, from nest of Yellow-vented Bulbul, *Pycnonotus goiavier*, 7 June 1961 (BPBM), examined.

*Sundochernes queenslandicus* Beier 1975: Holotype male, Marburg, Queensland, Australia [27°34'S, 152°35'E], litter and soil, 16 May 1966, K. E. Lee (SAM N197761), examined.

**Diagnosis.**—*Sundochernes* differs from all other chernetid genera by the following combination of characters: flagellum with 3 blades; spermathecae with 2 thickened tubes with rounded terminal bulbs; legs without tac-

tile setae; 1 pair of eyespots present; vestitural setae generally small, dentate and clavate.

**Remarks.**—Beier (1932, 1933) recorded three blades in the cheliceral flagellum in *Chelifer modiglianii*, and accordingly placed his new genus *Sundochernes* in the tribe Chernetini which was based primarily upon the number of cheliceral blades. Descriptions of species subsequently attributed to *Sundochernes* have either reiterated the possession of three cheliceral blades or have omitted flagellar blade counts.

MSH examined the syntypes of *C. modiglianii* during 1986 while identifying Indonesian specimens of pseudoscorpions (Harvey 1988), and made observations on the chelicerae and female genitalia. Drawings made at the time have been subsequently mislaid, and the syntypes have not been available to us again, precluding the provision of illustrations of generically important features. Nevertheless, notes made at the time of study indicate that the cheliceral flagellum consists of 3 blades, as stated by Beier (1932, 1933), and that the female genitalic region consists of spermathecae with 2 thickened tubes with rounded terminal bulbs.

Examination of the type or other material of most *Sundochernes* species (listed above) indicates that although some species possess three blades (e.g., *S. modiglianii*, *S. australiensis*, *S. dubius*, *S. brasiliensis*, *S. queenslandicus*, *S. gressitti*, and *S. malayanus*), others possess four blades. As noted above, this basic distinction in flagellar blade number has long been used to separate chernetid taxa, commencing with Beier (1932, 1933) who used flagellar number to diagnose the tribes Chernetini and Hesperochernetini within the Chernetinae. Although these tribes are no longer recognized, the number of flagellar setae is still given considerable significance in chernetid taxonomy (e.g., Muchmore 1974). Aside from flagellar blade number, the species with four blades have been found by us to possess fundamentally different spermathecal morphology from that found in *S. modiglianii* which is afforded high value in chernetid taxonomy. Our study suggests that these four species can be referred to two different genera with *S. guanophilus*, *S. dewae*, and *S. novae-guineae* placed in *Troglochernes*, and *S. grayi* in a new genus, here named *Satrapanus*. This makes *Sundochernes* a slightly more coherent

genus but the situation is further complicated by species such as *S. queenslandicus* which is clearly distinct from both *S. modiglianii*, *Troglochernes* and *Satrapanus*, suggesting that a further new genus will be required to accommodate it. The systematic position of the remaining species of *Sundochernes* can only be determined when detailed examination of each species is completed, with particular reference to spermathecal morphology as highlighted for other chernetids by Vachon (1938), Muchmore (1974, 1975) and Mahnert (1978).

#### Genus *Troglochernes* Beier 1969

*Troglochernes* Beier 1969:185; Harvey 1991:638.

**Type species.**—*Troglochernes imitans* Beier 1969, by original designation.

**Diagnosis.**—*Troglochernes* differs from all other chernetid genera by the following combination of characters: flagellum with 4 blades, or possibly 3 blades in one species; spermathecae with 2 thickened and slightly curved tubes fused basally; legs without tactile setae; carapace unicolored and with two transverse furrows; eyes or eyespots absent; vestitural setae generally small, dentate and clavate.

**Description.**—*Adults*: Vestitural setae mostly short, slightly curved, and dentate.

*Pedipalps*: with most surfaces finely to heavily granulate. Fixed finger with 8 trichobothria, movable chelal finger with 4 trichobothria; *esb* closer to *eb* than to *est*; *isb* approximately midway between *it* and *ist*; *it* situated in distal third of fixed finger; *sb* closer to *b* than to *st*. Marginal teeth of chela all closely spaced; both chelal fingers with external and internal rows of accessory teeth. Venom apparatus present in movable finger with nodus ramosus terminating midway between *t* and *st*, or adjacent to *st*.

*Chelicera*: with 6 or 7 setae on hand; *ls* and *is* acuminate, *sbs*, *bs'*, *bs''* and *bs'''* (when present) dentate, *es* either acuminate (most species) or dentate (*T. omorgus*); movable finger with 1 acuminate seta (*gs*); with 2 dorsal and 1 ventral lyrifissures; lamina exterior present; movable finger with 1 dorsal tooth; galea long and slender with 5–6 rami; flagellum composed of 4 blades, or possibly 3 blades in one species; two anterior blades dentate along distal anterior half, two shorter blades smooth, or in case of species with 3 blades, anterior blade dentate and others smooth.

*Cephalothorax*: carapace with eyes or eyespots absent; unicolored; with two transverse furrows; posterior margin straight or nearly so. Median maxillary lyrifissure present and sub-medially situated; posterior maxillary lyrifissure present.

*Abdomen*: tergites and sternites generally divided. Pleural membrane wrinkled striate for entire length, without setae, but females of two species with setae. Each stigmatic sclerite with 1 or more setae. Spiracles simple, with spiracular helix.

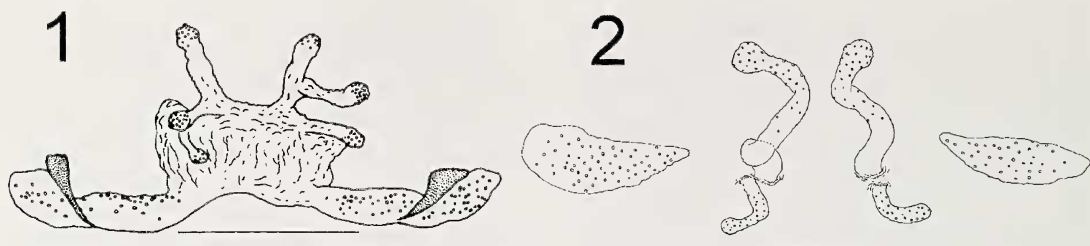
*Genitalia*: male genitalia of typical chernetid form; female spermathecae with 2 thickened and curved tubes fused basally.

*Legs*: legs I and II with an oblique junction between femur and patella; legs III and IV without tactile setae on tibiae or tarsi; metatarsus and tarsus fused into single segment (tarsus); tarsi with single raised slit sensillum; subterminal tarsal seta curved and acuminate; tarsal claws simple; arolium slightly shorter than claws.

*Nymphs*: Much like adults, but trichobothrial patterns as follows: tritonymph with 7 on fixed finger and 3 on movable finger; deutonymph with 6 on fixed finger and 2 on movable finger; and protonymph with 3 on fixed finger and 1 on movable finger. Chelicera of protonymph lacking seta *gs*. Tarsi of protonymph without single raised slit sensillum.

**Remarks.**—Beier (1969) proposed the new genus *Troglochernes* for *T. imitans*, a highly troglomorphic species from caves on the Nullarbor Plain, Western Australia. He treated the genus as a member of the Hesperochernetini as it possessed four flagellar blades, and distinguished it from most other genera by the elongate pedipalps and legs, and lack of a tactile seta on the posterior tarsi. Our examination of the female spermathecae of *T. imitans* (Fig. 14) reveals a form unlike that documented for any other Australasian chernetid genus and we consider the genus distinct from all other previously described chernetid genera on the basis of this character. Other Australasian species with extremely similar spermathecae have been detected, and despite the lack of extreme troglomorphisms, we include them here in *Troglochernes* and extend the diagnosis of the genus to include less highly troglomorphic species than *T. imitans*. Three of these species which are here transferred to *Troglochernes* were previously placed in the





Figures 1, 2.—Spermathecae, ventral: 1. *Nesochernes gracilis norfolkensis* Beier, female from Norfolk Island, Australia (WAM T68620); 2. *Paraustrochernes victorianus* Beier, female from Cumberland Falls, Victoria, Australia (WAM T66536). Scale lines = 0.1 mm.

genus *Sundochernes* by Beier (1965, 1967b), but we cannot agree with this placement as they are clearly not congeneric with the type species, *S. modiglianii* (Ellingsen). Some other species currently included within *Sundochernes* are not congeneric with *S. modiglianii*, and we discuss these problems in more detail under that genus. In addition, we have found that all species here attributed to *Troglochernes* lack eye-spots, a feature that further distinguishes it from *Sundochernes*.

Species of *Troglochernes* differ from the other Australasian chernetid genera with four blades in the flagellum as follows: from *Austrochernes* Beier 1932 by the lack of tactile setae on tarsus IV [present in *Austrochernes*, see With (1905) and Beier (1932)]; from *Paraustrochernes* Beier 1966 by the unicolored carapace [bicolored metazone in *Paraustrochernes*; see Beier (1966)], and the presence of only a single pair of spermathecae in the female genitalia [two pairs of spermathecae in *P. victorianus* (Fig. 2)]; and from *Marachernes* Harvey 1992a by the general shape of the chelal hand (which is not much wider than the base of the fingers in *Marachernes*) and the lack of an internobasal mound bearing accessory teeth on the male movable chelal finger (Harvey 1992a, 1994). It differs from *Satrapanus* by the lack of eye-spots, which are present in *Satrapanus*, by the morphology of the female genitalia in which the spermathecae are usually lightly curved, and by the color of the carapace which is uniformly unicolored in *Troglochernes*, but is distinctly bicolored in *Satrapanus*, with the metazone paler than the remaining carapace.

Apart from these Australian genera, only 12 other genera, mostly from the northern hemisphere, have been reported as lacking tactile

setae on the posterior tarsi and possessing four blades in the flagellum [Muchmore (1974) reported that species of *Chernes* mostly have a four-bladed flagellum, but Dr. V. Mahnert (in litt.) informs me that three-bladed specimens are equally abundant]. *Troglochernes* differs from these genera as follows:

The spermathecal morphology of two thickened and curved tubes that are fused basally segregates *Troglochernes* from *Chelodamus* R.V. Chamberlin 1925 (from Central America), *Chernes* Menge 1855 (from Europe, North Africa, Asia and North America), *Hesperochernes* Chamberlin 1924 (from North America and Japan), *Chelanops* Gervais 1849 (from South America), *Semeiochernes* Beier 1932 (from South America), and *Illinichernes* Hoff 1949 (from North America), which all possess long, slender spermathecae (Benedict & Malcolm 1982; Chamberlin 1952; Mahnert 1978, 1987; Muchmore 1974, 1975, 1984, 1999), and from *Gigantochernes* Beier 1932 (from South America) and *Cocinachernes* Hentschel & Muchmore 1989 (from Mexico), which have four (*Cocinachernes*) or apparently five (*Gigantochernes*) short spermathecal tubes (Hentschel & Muchmore 1989; Vitali-di Castri 1972).

The spermathecal morphology of *Atherochernes* Beier 1954a (from Venezuela), *Eumecochernes* Beier 1932 (from Hawaii) and *Nesochernes* Beier 1932 (from New Zealand and Norfolk Island) are unknown but each can be readily separated from *Troglochernes*. *Atherochernes* differs by the presence of 5 setae on the cheliceral hand (6 or more setae in *Troglochernes*), and by the presence of accessory teeth only on the movable chelal finger (accessory teeth on both chelal fingers in *Troglochernes*) (Beier 1954a). *Eumecochernes* has

trichobothrium *isb* situated basally to *est* (Beier 1932), whereas it is situated opposite or slightly distal to *est* in *Troglochernes*. Specimens of *Nesochernes gracilis norfolkensis* have spermathecae with three pairs of ducts each distally with small pores (Fig. 1); this arrangement is quite different to that of *Troglochernes*.

While most species of *Ceriochernes* Beier 1937, including the type species, *C. detritus* Beier 1937 from the Philippines, *C. foliaceosetosus* Beier 1974a from Brazil and *C. vestitus* Beier 1974b from Nepal and Pakistan, possess three flagellar blades (Beier 1937, 1974b, 1974a; Dashdamirov 2005), the Brazilian species *C. amazonicus* Mahnert 1985 possesses four blades (Mahnert 1985). The number of flagellar blades has not been reported for the remaining species currently included in the genus—*C. besucheti* Beier 1973 from Sri Lanka, *C. nepalensis* Beier 1974b and *C. martensi* Beier 1974b from Nepal, and *C. brasiliensis* Beier 1974a from Brazil (Beier 1973, 1974b, 1974a). Lack of knowledge of the morphology of the spermathecae for most species of *Ceriochernes* is severely hampering our understanding of this widespread and un-

doubtedly paraphyletic genus (Dashdamirov 2005). The sole member of *Ceriochernes* that has four flagellar blades and lacks tactile setae on the posterior tarsi, *C. amazonicus*, has highly unusual spermathecae in which there are numerous spermathecal bulbs, each circular on long thin stalks, leading from a central atrium (Mahnert 1985).

**Ecology.**—Although habitat preferences are unknown for *T. novaeguineae*, the remaining five species of *Troglochernes* occur in caves or are intimately associated with other animals. *Troglochernes guanophilus*, *T. cruciatus* and the highly troglomorphic *T. imitans* are known from caves where they inhabit guano deposits or reside under nearby rocks or leaf litter lying on the floor of the cave. *Troglochernes dewae* has been collected solely from bird nests, including that of the Galah (*Cacatua roseicapilla*), Sulphur-Crested Cockatoo (*C. galerita*), Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and Rufous Treecreeper (*Climacteris rufa*). The sole specimen of *T. omorgus* found attached phoretically to the beetle *Omorgus costatus* (Trogidae), individuals of which are known to occur in caves where they live and breed in bat guano (Scholtz 1986).

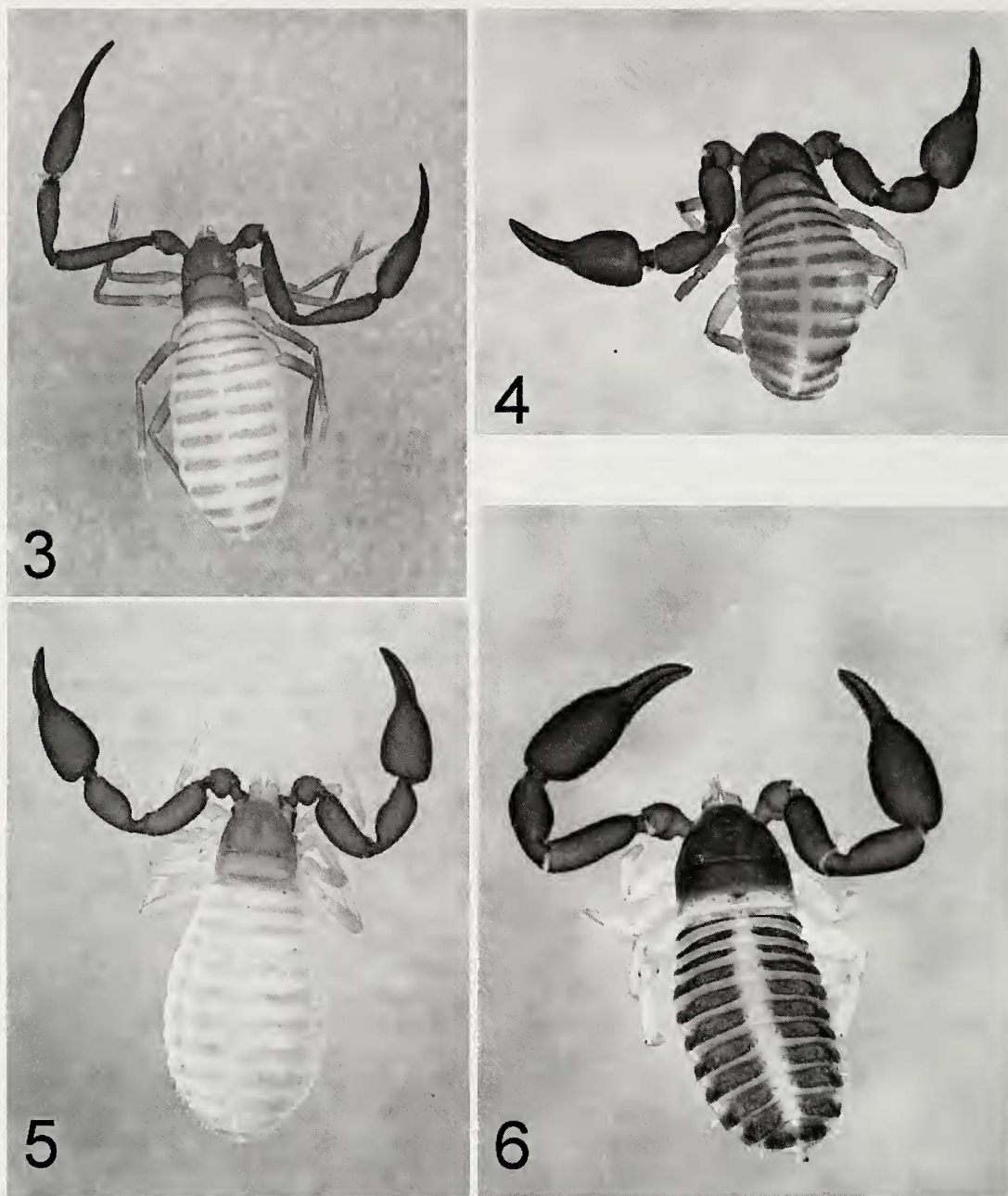
KEY TO SPECIES OF *TROGLOCHERNES*

- 1. Large species with long, slender pedipalps, e.g., chela (with pedicel) 2.036–2.408 (♂), 1.992–2.528 (♀) mm long and 4.98–5.39 (♂), 4.58–5.49 (♀) times longer than wide . . . . . *Troglochernes imitans*  
Small species with short, robust pedipalps, e.g., chela (with pedicel) 1.00–1.34 (♂), 1.05–1.61 (♀) mm long and 2.50–3.00 (♂), 2.45–2.99 (♀) times longer than wide . . . . . 2
- 2. Posterior margin of carapace with 25 setae; tergites generally with more than 30 setae . . . . . *Troglochernes omorgus*  
Posterior margin of carapace with less than 20 setae; tergites generally with less than 30 setae . . . . . 3
- 3. Cheliceral seta *es* dentate; posterior margin of carapace with 16–20 setae . . . . . *Troglochernes dewae*  
Cheliceral seta *es* acuminate; posterior margin of carapace with 8–16 setae . . . . . 4
- 4. Posterior margin of carapace with 8 setae . . . . . *Troglochernes novaeguineae*  
Posterior margin of carapace with 10 or more setae . . . . . 5
- 5. Posterior margin of carapace with 10–12 setae . . . . . *Troglochernes guanophilus*  
Posterior margin of carapace with 14–16 setae . . . . . *Troglochernes cruciatus*

*Troglochernes imitans* Beier 1969  
Figs. 3, 7–14, 71  
*Troglochernes imitans* Beier 1969:185–187, fig. 1; Richards 1971:19, 24, 25, 27, 28, 30, 43; Beier 1975:203; Harvey 1981:247; Harvey 1985:136; Harvey 1991:638; Moulds 2004:12.

**Type material examined.**—AUSTRALIA:  
*Western Australia:* Holotype male, Dingo Cave [6N-160], Nullarbor Plain, Western Australia, Australia [31°51'S, 126°44'E], near entrance, 28 October 1968, J. Lowry (SAM N1980192). Allotype female, same data as ho-



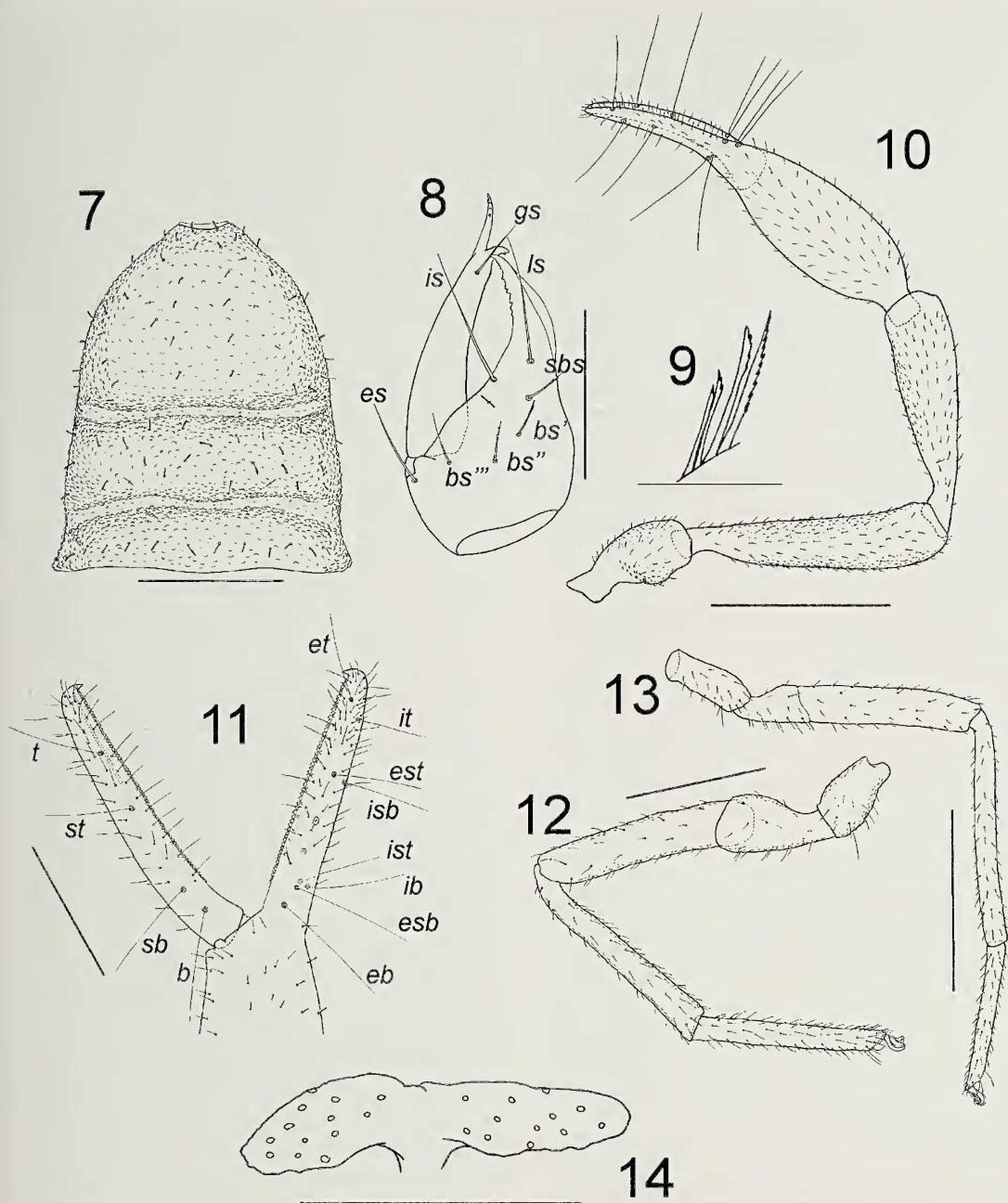


Figures 3–6.—3. *Trogloderes imitans* Beier, male from Scudd Cave, Western Australia (WAM 98/1508); 4. *Trogloderes dewae* (Beier), female from Gingin Shire, Western Australia (WAM T48341); 5. *Trogloderes cruciatus*, sp. nov., female paratype from Rope Ladder Cave, Queensland (WAM T68621); 6. *Satrapanus grayi* (Beier), female from Lord Howe Island (AM).

holotype (SAM N1980193). Paratypes: 2 females, same data as holotype (NHMW).

**Other material examined.**—AUSTRALIA: *Western Australia*: 1 ♀, Murra-El-Elevyn Cave [6N-47] [32°02'S, 126°02'E], on dry guano, 21 April 1973, K. Williamson (WAM

74/361); 1 ♀, Murra-El-Elevyn Cave [6N-47] [32°02'S, 126°02'E], under mineral crusts, 21 April 1973, P.J. Bridge (WAM 74/362); 1 ♂, Tiggas Lair, 21.9 km E of Nurina [ca. 30°59'S, 126°53'E], 1 December 1985, C.E. Brown, S.J. Elliott, T.A. Smith (WAM 98/1515); 2 ♂,



Figures 7–14.—*Troglocheres imitans* Beier, female from Murra-El-Elevyn Cave, Western Australia (WAM 74/361), unless stated otherwise: 7. Carapace; 8. Left chelicera; 9. Flagellum; 10. Right pedipalp, dorsal (note that *est* is absent); 11. Left chelal fingers, lateral; 12. Left leg I; 13. Left leg IV; 14. Spermathecae, ventral, female from Scudd Cave (WAM 98/1511). Scale lines = 1.00 mm (Figs. 10, 13), 0.50 mm (Figs. 7, 11, 12), 0.20 mm (Fig. 8), 0.1 mm (9, 14). See Methods for abbreviations.

2 ♀, Scudd Cave [N-520], Kybo Station [31°10'S, 126°29'E], 13 April 1989, A. Baynes (WAM 98/1511–1514); 3 ♂, Phyllistine Flattener Cave, 6N-194 [31°32'54"S, 127°18'

40"E], Madura Station, under rocks, dark zone, 6 January 1997, N. Poulter (WAM 98/1508–1510).

**Diagnosis.**—*Troglocheres imitans* differs



from all other species of the genus by the extremely elongate pedipalps and legs.

**Description.**—*Adults*: Pedipalps and carapace dark reddish-brown; legs reddish-brown; abdomen pale yellow-brown in color. Vestitural setae short, slightly curved, and dentate; most sternal setae acicular with few dentate.

Pedipalps (Fig. 10): all segments extremely elongate, with trochanter 1.95–2.20 (♂), 1.94–2.44 (♀), femur 4.89–5.27 (♂), 4.58–5.23 (♀), patella 3.85–4.16 (♂), 3.90–4.28 (♀), chela (with pedicel) 4.98–5.39 (♂), 4.58–5.49 (♀), chela (without pedicel) 4.66–5.09 (♂), 4.30–4.53 (♀), hand 2.37–2.91 (♂), 2.19–2.24 (♀) times longer than wide; movable finger 0.84–1.04 (♂), 1.00–1.18 (♀) times as long as hand. Surfaces of trochanter and femur moderately granulate, of patella and chelal hand finely granulate, chelal fingers smooth. Fixed finger with ca. 68 (♂), 67 (♀) marginal teeth, plus 12 (♂), 13 (♀) external accessory teeth and 5 (♂, ♀) internal accessory teeth; movable finger with ca. 75 (♂), 72 (♀), marginal teeth, plus 11 (♂), 10 (♀) external accessory teeth and 6 (♂), 5 (♀) internal accessory teeth. Pedipalpal setae generally slender and clavate-dentate, except on fingers where they are acuminate. Fixed finger with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 11); *esb* closer to *eb* than to *est*; *est* closer to *et* than to *esb*; *isb* inserted dorsally, rather than internally or externally, and closer to *it* than to *ist*; *ist* closer to *ib* than to *isb*; *est* absent from the right pedipalp of 1 female (Fig. 10); *sb* closer to *b* than to *st*; *st* closer to *t* than to *sb*. Venom apparatus present in movable finger with nodus ramosus terminating midway between *t* and *st* (Fig. 11). External margin of fixed chelal finger with 2–3 “sense spots.”

Chelicera (Fig. 8): with 6–7 setae on hand; *ls*, *is* and *es* acuminate, *sbs*, *bs'*, *bs''* and *bs'''* (when present) dentate; movable finger with 1 acuminate seta (*gs*); with 2 dorsal and 1 ventral lyrifissures. Movable finger with single dorsal tooth. Galea long and slender with 3 distal and 2 sub-distal to medial rami. Flagellum (Fig. 9) composed of 4 blades; each blade dentate along the distal anterior half. Serrula exterior with 20 (♂), 18 (♀) lamellae.

Cephalothorax: carapace (Fig. 7) 1.11–1.25 (♂), 1.07–1.18 (♀) times as long as broad; unicolorous; eyes absent; with 6 (♂, ♀) setae on anterior margin, with 10–11 (♂, ♀) setae

on posterior margin; posterior half with two moderately incised transverse furrows, anterior furrow crosses the carapace at ca. 0.55 of its length, posterior furrow crosses at ca. 0.80 of carapace length; entirely granulate with exception of transverse furrows; posterior margin gently undulate. Manducatory process with 1 long distal and 1 long sub-distal seta, with sub-oral seta; remainder of maxilla with 40 (♂), 42 (♀) setae. Chaetotaxy of coxae I–IV: 13: 16: 20: ca. 45 (♂), 13: 14: 21: ca. 55 (♀).

Abdomen: tergites I–X and sternites IV–X divided. Tergal chaetotaxy: ♂, 16: 14: 14: 16: 19: 23: 21: 22: 22: 18: 22: 2; ♀, 12: 13: 14: 18: 19: 18: 22: 21: 21: 17: 18: 2; setae usually restricted to posterior and lateral tergal margins. Sternal chaetotaxy: ♂, ca. 110: (3) 41 [12] (3): (4) 12 (4): 16: 16: 16: 17: 15: 18: 14: 2; ♀, ca. 60: (3) 15 (3): (4) 9 (4): 17: 15: 16: 16: 15: 16: 13: 2; posterior segments without tactile setae. Pleural membrane wrinkled and somewhat longitudinally striate for entire length, without setae.

Male genital opercula with numerous setae that are long and curved; anterior operculum with one pair of large slit sensilla; posterior operculum with 8 smaller sensilla. Female genital opercula: anterior operculum with numerous setae and 2 slit sensilla. Male genitalia of typical chernetid form (Vachon 1938). Female spermathecae with 2 thickened, slightly curved, and laterally directed tubes fusing near the genital operculum (Fig. 14).

Legs: legs I and II with an oblique junction between femur and patella (Fig. 12). Leg IV (Fig. 13) with femur + patella 6.56 (♂), 6.97 (♀) times longer than wide. Tibiae and tarsi of legs III and IV without tactile setae. Tarsi with single raised slit sensillum. Tarsal claws simple; arolium slightly shorter than claws.

**Dimensions (mm).**—*Male from Scudd Cave, Western Australia (WAM 98/1513), with other specimens in parentheses, where appropriate*: Body length 3.49 (3.23–4.50). Pedipalps: trochanter 0.710/0.364 (0.638–0.727/0.292–0.338), femur 1.664/0.320 (1.356–1.566/0.275–0.320), patella 1.421/0.346 (1.181–1.381/0.301–0.340), chela (with pedicel) 2.408/0.447 (2.036–2.384/0.389–0.460), chela (without pedicel) 2.208 (1.952–2.260), hand length 1.150 (0.960–1.189), movable finger length 1.200 (0.995–1.134). Chelicera 0.384/0.211, movable finger length

0.289. Carapace 1.336/1.128 (1.088–1.285/0.946–1.085). Leg I: femur 0.496/0.218, patella 0.830/0.168, tibia 0.928/0.115, tarsus 0.736/0.082. Leg IV: femur + patella 1.429/0.218, tibia 1.352/0.114, tarsus 0.864/0.098.

*Female from Scudd Cave, Western Australia (WAM 98/1511), with other specimens in parentheses, where appropriate:* Body length 4.74 (3.94–4.25). Pedipalps: trochanter 0.784/0.395 (0.662–0.760/0.290–0.356), femur 1.696/0.351 (1.344–1.580/0.280–0.315), patella 1.474/0.364 (1.202–1.400/0.290–0.329), chela (with pedicel) 2.528/0.525 (1.992–2.390/0.385–0.469), chela (without pedicel) 2.376 (1.872–2.112), hand length 1.184 (0.952–1.049), movable finger length 1.200 (0.947–1.175). Chelicera 0.390/0.185, movable finger length 0.294. Carapace 1.376/1.288 (1.072–1.179/0.952–1.040). Leg I: femur 0.493/0.232, patella 0.864/0.172, tibia 0.910/0.116, tarsus 0.752/0.083. Leg IV: femur + patella 1.523/0.218, tibia 1.342/0.126, tarsus 0.880/0.096.

**Remarks.**—This highly troglomorphic species differs from all other species of the genus by the elongate pedipalps and legs (Figs. 3, 10, 12, 13). *Troglochernes imitans* has been found in seven caves situated on the western edge of the Nullarbor Plain (Fig. 71): Dingo Cave (6N-160) (Beier 1969; Richards 1971), Cocklebidy Cave (6N-48, 31°57'S, 125°55'E), Pannikin Plain Cave (6N-49, 32°02'S, 126°11'E), Murra-El-Elevyn Cave (6N-47) (Beier 1975), Tiggas Lair, Scudd Cave (N-520) and Phyllistine Flattener Cave (6N-194) (this study). Accurate habitat data are lacking for most specimens but individuals have been found under stones or mineral crusts, or on dry guano, presumably produced by the Chocolate Wattled Bat, *Chalinolobus morio* (Gray). Richards (1971) recorded *T. imitans* from bat guano and decaying vegetation in the dark zone of Dingo Cave.

***Troglochernes guanophilus* (Beier 1967)**

new combination

Figs. 15–23, 71

*Sundochernes guanophilus* Beier 1967b:202–203, fig. 3; Dew 1968:35; Harvey 1981:247; Harvey 1985:136; Harvey 1991:635; Moulds 2004:12.

**Type material.**—AUSTRALIA: *New South Wales*: Holotype male, Fig Tree Cave [2W-148], near Wombeyan [34°20'S, 149°55'E], in guano, 19 February 1963, B. Dew

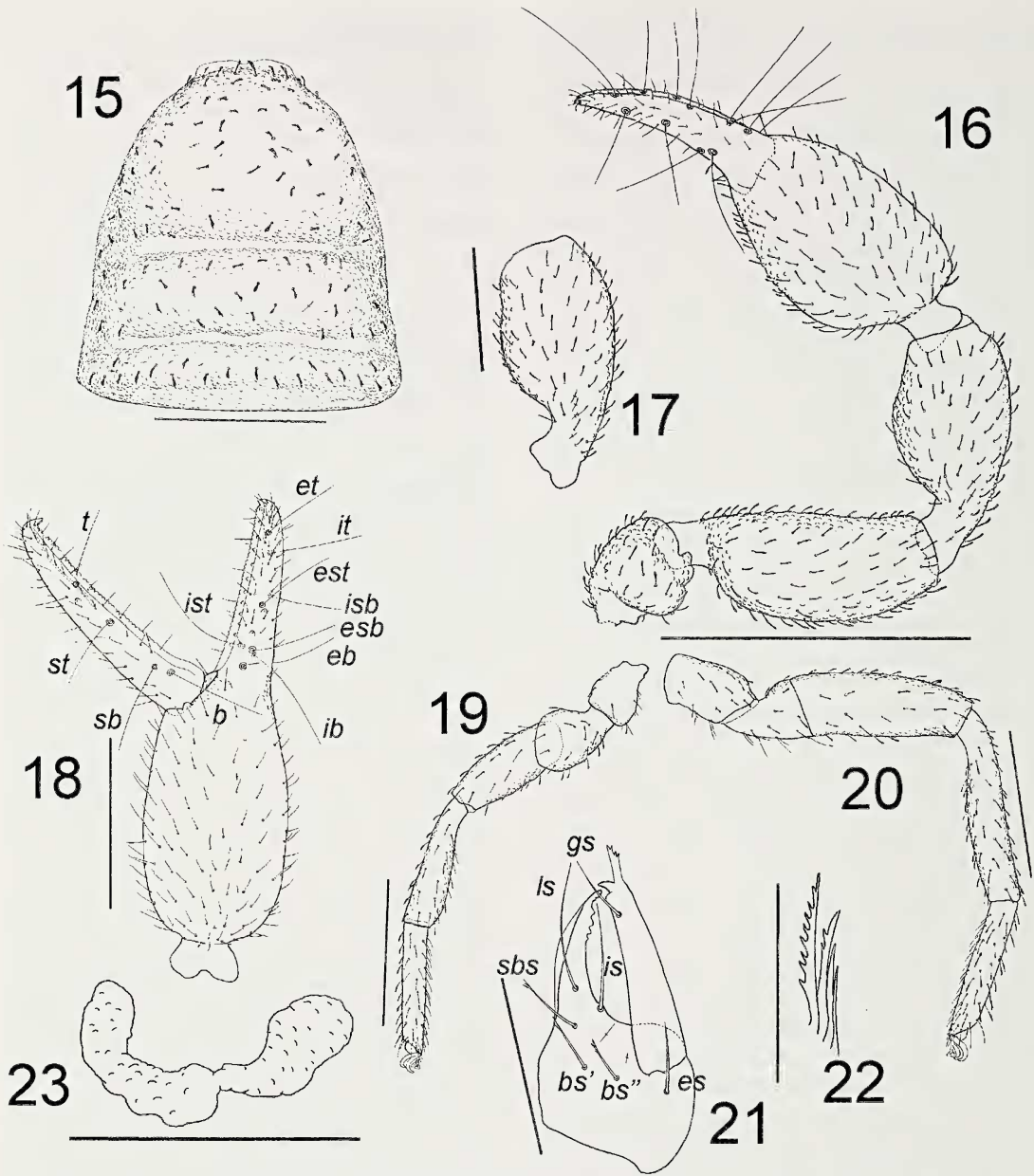
(SAM N1966163). Allotype female, same data as holotype (SAM N1966164). Paratype: 1 female, same data as holotype (NHMW).

**Diagnosis.**—*Troglochernes guanophilus* differs from *T. imitans* in the lack of long slender appendages, from *T. cruciatus* in the number of setae on the posterior margin of the carapace (10–12 in *T. guanophilus* and 14–16 in *T. cruciatus*), from *T. dewae* by the morphology of the male pedipalpal patella (expanded internal margin in *T. dewae*, not so expanded in *T. guanophilus*), and from *T. novaeguineae* by the more robust pedipalpal patella (2.2–2.3 times longer than wide in *T. guanophilus*, and 2.62 times in *T. novaeguineae*).

**Description.**—*Adults*: Pedipalps and carapace dark reddish-brown; abdomen and legs deep red-brown in color. Vestitural setae short, slightly curved, and dentate; most sternal setae acicular with few dentate, especially on posterior sternites.

Pedipalps (Figs. 16, 17): robust, with trochanter 1.63 (♂), 1.83 (♀), femur 2.64 (♂), 2.64 (♀), patella 2.24 (♂), 2.32 (♀), chela (with pedicel) 2.93 (♂), 2.99 (♀), chela (without pedicel) 2.72 (♂), 2.83 (♀), hand 1.40 (♂), 1.41 (♀) times longer than wide; movable finger 0.96 (♂), 1.02 (♀) times as long as hand. Most surfaces of pedipalp finely to heavily granulate with exception of dorsal and ventral surfaces of chelal hand and finger, and entire movable finger. Fixed finger with 36 (♂, ♀) marginal teeth, plus 12 external accessory teeth and 5 internal accessory teeth; movable finger with 36 (♂, ♀) marginal teeth, plus 6 external accessory teeth and 5 internal accessory teeth. Pedipalpal setae clavate-dentate, long and slender, except on fingers where they are acuminate. Fixed finger with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 18); *esb* closer to *eb* than to *est*; *est* closer to *esb* than to *et*, which is situated in distal quarter of fixed finger; *isb* slightly closer to *ist* than to *it*; *ist* closer to *ib* than to *isb*; *sb* closer to *b* than to *st*; *st* slightly closer to *t* than to *sb*. Venom apparatus present in movable finger with nodus ramosus terminating midway between *t* and *st* (Fig. 18). External margin of fixed chelal finger with 1 “sense spot,” internal margin of fixed chelal finger with 1 “sense spot,” and external margin of movable chelal finger with 1 “sense spot.”





Figures 15–23.—*Troglochernes guanophilus* (Beier), male holotype (SAM N1966163) and female allotype (SAM N1966164): 15. Carapace, dorsal, male; 16. Right pedipalp, dorsal, male; 17. Right pedipalpal patella, female; 18. Left chela, lateral, male; 19. Left leg I, male; 20. Left leg IV, male; 21. Right chelicera, male; 22. Left flagellum, female; 23. Spermathecae, female. Scale lines = 1.00 mm (Figs. 16–18), 0.50 mm (Figs. 15, 19, 20), 0.20 mm (Fig. 21), 0.10 mm (22, 23). See Methods for abbreviations.

Chelicera (Fig. 21): with 6 setae on hand; *ls*, *is* and *es* acuminate, *sbs*, *bs'* and *bs''* dentate; movable finger with 1 acuminate seta (*gs*); with 2 dorsal and 1 ventral lyrifissures. Movable finger with single dorsal tooth. Galea long and slender, with 3 small distal and 2

small subdistal rami. Flagellum (Fig. 22) composed of 4 blades; distal blades dentate along the distal anterior half, subdistal blade with 2 serrations, other blades smooth. Serrula exterior with 17 (♂, ♀) lamellae.

Cephalothorax: carapace (Fig. 15): 1.10

(♂), 1.07 (♀) times as long as broad; unicolorous; eyes absent; with 6 setae on anterior margin, and 20 setae on posterior margin; posterior half with two moderately incised transverse furrows, anterior furrow crosses the carapace at ca. 0.54 (♂), 0.53 (♀) of its length, posterior furrow crosses at ca. 0.85 (♂, ♀) of carapace length; entirely granulate with exception of transverse furrows; posterior margin straight. Manducatory process with 1 long distal and 1 long sub-distal seta, with sub-oral seta; remainder of maxilla with 28 (♂), 29 (♀) setae. Chaetotaxy of coxae I–IV: 11: 12: 19: 34 (♂), 15: 18: 19: 47 (♀).

Abdomen: tergites I–X and sternites IV–X divided, tergite XI and sternite XI partially divided. Tergal chaetotaxy: holotype ♂, 22: 22: 19: 21: 25: 31: 30: 26: 29: 25: 18: 2, allotype ♀, 25: 24: 21: 25: 30: 31: 30: 28: 30: 24: 16: 2; setae usually restricted to posterior and lateral tergal margins; without abdominal tactile setae. Sternal chaetotaxy: holotype ♂, 79: (2) 27 [4+4] (3): (4) 10 (3): 19: 21: 19: 21: 22: 21: 18: 2, allotype ♀, 55: (3) 14 (3): (1) 9 (1): 16: 20: 21: 21: 22: 25: 14: 2. Pleural membrane wrinkled striate for entire length, without setae.

Male genital anterior operculum with long, curved setae (some reaching the genital opening); one pair of slit sensilla on anterior and posterior opercula, posterior operculum with smaller sensilla. Female genital opercula: anterior operculum with numerous setae and 3 slit sensilla, apparently formed by duplication of sensillum on left side. Male genitalia of typical chernetid form (Vachon 1938). Female spermathecae with 2 thickened and slightly curved tubes fusing near the genital operculum (Fig. 23).

Legs: legs I and II with an oblique junction between femur and patella (Fig. 19). Leg IV (Fig. 20) with femur + patella 4.02 (♂), 4.22 (♀) times longer than wide. Tibiae and tarsi of legs III and IV without tactile setae. Tarsi with single raised slit sensillum. Tarsal claws simple; arolium slightly shorter than claws.

**Dimensions (mm).**—*Male holotype* (SAM N1966163): Body length 3.36. Pedipalps: trochanter 0.512/0.314, femur 0.915/0.347, patella 0.830/0.371, chela (with pedicel) 1.424/0.486, chela (without pedicel) 1.322, hand length 0.680, movable finger length 0.656. Chelicera 0.314/0.170, movable finger length 0.218. Carapace 0.944/0.862. Leg I: femur

0.264/0.198, patella 0.424/0.164, tibia 0.468/0.114, tarsus 0.438/0.083. Leg IV: femur + patella 0.848/0.211, tibia 0.669/0.127, tarsus 0.506/0.096.

*Female allotype* (SAM N1966164): Body length 3.97. Pedipalps: trochanter 0.528/0.289, femur 0.850/0.322, patella 0.829/0.358, chela (with pedicel) 1.456/0.487, chela (without pedicel) 1.379, hand length 0.688, movable finger length 0.704. Chelicera 0.309/0.148, movable finger length 0.223. Carapace 0.952/0.888. Leg I: femur 0.262/0.187, patella 0.429/0.160, tibia 0.461/0.127, tarsus 0.554/0.081. Leg IV: femur + patella 0.866/0.205, tibia 0.668/0.128, tarsus 0.517/0.096.

**Remarks.**—*Sundochernes guanophilus* has four blades in the flagellum and spermathecal morphology that demonstrates that this species cannot be retained in *Sundochernes*, and is here transferred to *Troglochernes*. Thus far, *T. guanophilus* is known only from Fig Tree Cave, located near Wombeyan in south-eastern New South Wales (Fig. 71).

### *Troglochernes dewae* (Beier 1967)

new combination

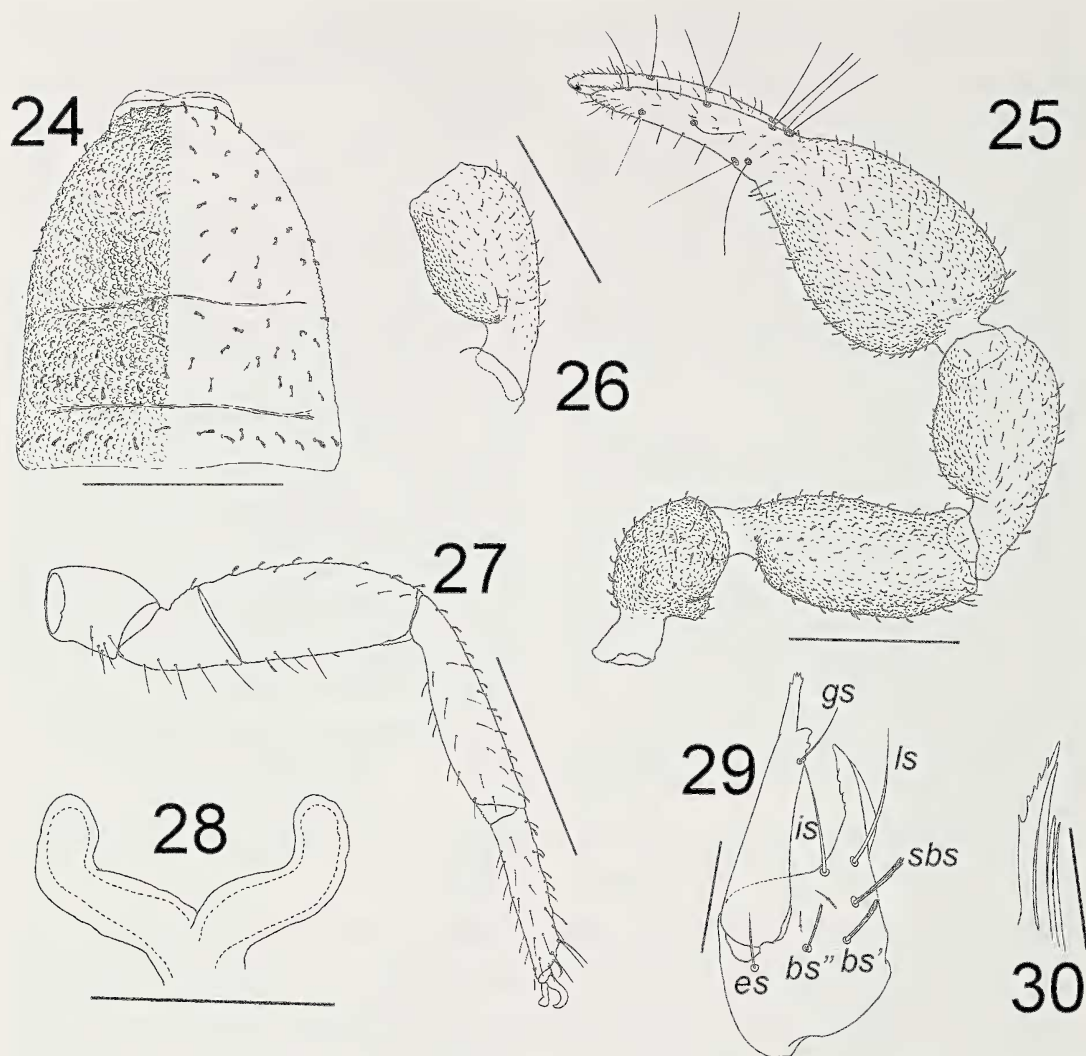
Figs. 4, 24–33, 71

*Sundochernes dewae* Beier 1967b:200–202, fig. 2; Harvey 1981:247; Harvey 1985:135; Harvey 1991:635.

**Type material.**—AUSTRALIA: *New South Wales*: Holotype male, Brewarrina [29°58'S, 146°52'E], from nest of Galah (*Cacatua roseicapilla*) in hollow tree, June 1964, B. Dew (AM KS5867). Paratypes: 1 female, 2 tritonymphs, 2 deutonymphs, 1 protonymph, same data as holotype (AM KS5868); 1 male, 2 female, 1 nymph, same data as holotype (NHMW).

**Other material examined.**—AUSTRALIA: *Queensland*: 1 ♂, Fringe Dwellers, Iron Range [ca. 12°38'S, 143°05'E], 9 October 1998, nest of *Cacatua galerita* [Sulphur-Crested Cockatoo], S. Legge, R. Heinsohn (WAM T66299); *Western Australia*: 1 ♀, 1 tritonymph, Gingin Shire at 30°59'S, 115°45'E, 20 November 1998, ex *Calyptorhynchus latirostris* nest, nest 84, P. Mawson (WAM T48341); 1 ♂, Shire of Moora at 30°35'S, 116°01'E, 20 November 1998, ex *Cacatua latirostris* nest in healthy hollow of *Eucalyptus salmonophloia*, P. Mawson (WAM T66300); 1 ♂, 1 ♀, 2 tritonymphs, 1 deutonymph, Yilliminning Agricultural Region at





Figures 24–30.—*Troglochernes dewae* (Beier), specimens from Yilliminning Agricultural Region, Western Australia (WAM T66301): 24. Carapace, dorsal, male; 25. Right pedipalp, dorsal, female; 26. Right pedipalpal patella, dorsal, male; 27. Left leg IV, male; 28. Spermathecae, female; 29. Left chelicera, male; 30. Left flagellum, male. Scale lines = 0.50 mm (Figs. 24–27), 0.20 mm (Fig. 29), 0.10 mm (Fig. 28), 0.05 mm (Fig. 30). See Methods for abbreviations.

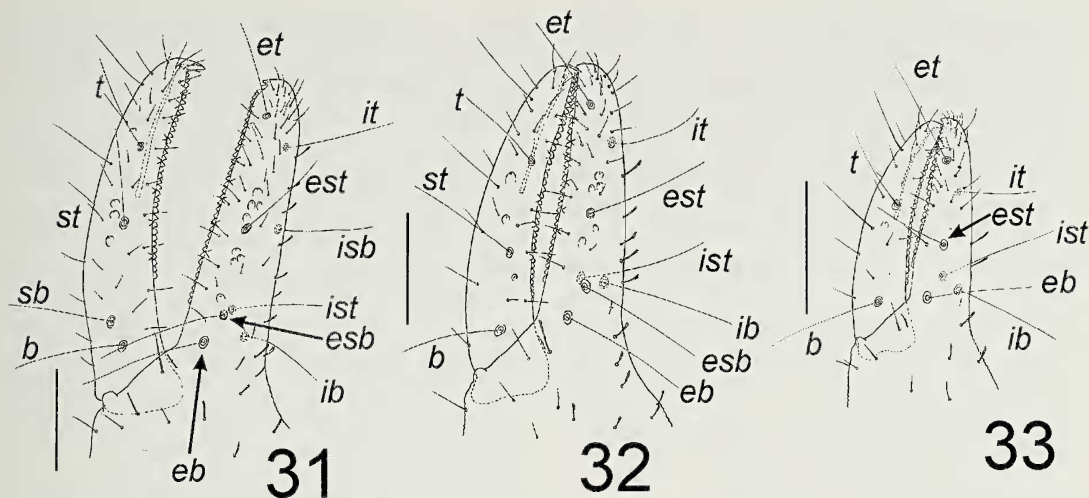
32°56'S, 117°25'E, 6 March 1999, ex *Climacteris rufa* [Rufous Treecreeper] nest, nest 206, G. Luck (WAM T66301).

**Diagnosis.**—*Troglochernes dewae* differs from all other members of the genus by the acuminate cheliceral seta *es*, the presence of 16–20 setae on the posterior margin of the carapace, and the strongly convex medial margin of the pedipalpal patella.

**Description.**—*Adults*: Pedipalps and carapace deep reddish-brown; abdomen and legs light yellowish brown in color (Fig. 4). Ves-

titular setae short, slightly curved, and dentate; most sternal setae acicular with few dentate.

Pedipalps (Figs. 25, 26): robust, with trochanter 1.48–1.60 (♂), 1.57–1.68 (♀), femur 2.22–2.55 (♂), 2.45–2.55 (♀), patella 2.04–2.14 (♂), 2.10–2.16 (♀), chela (with pedicel) 2.81–2.90 (♂), 2.80–2.85 (♀), chela (without pedicel) 2.67–2.71 (♂), 2.65–2.72 (♀) and hand 1.25–1.41 (♂), 1.30–1.33 (♀) times longer than wide; movable finger 1.08–1.17 (♂), 1.04–1.16 (♀) times longer than hand. All



Figures 31–33.—*Troglocheres dewae* (Beier), specimens from Yilliminning Agricultural Region, Western Australia (WAM T66301): 31. Left chelal fingers, lateral, female; 32. Left chelal fingers, lateral, tritonymph; 33. Left chelal fingers, lateral, deutonymph. Scale lines = 0.20 mm. See Methods for abbreviations.

surfaces of pedipalp finely to heavily granulate with exception of distal half of fixed chelal finger, and entire movable finger. Patella with mesal margin inflated and rounded. Fixed finger with 35 (♂), 36 (♀) marginal teeth, plus 13 (♂), 9 (♀) external accessory teeth and 9 (♂), 8 (♀) internal accessory teeth; movable finger with 41 (♂, ♀) marginal teeth, plus 12 (♂), 8 (♀) teeth external accessory teeth and 6 (♂), 5 (♀) internal accessory teeth. Pedipalpal setae stout and clavate-dentate, except on fingers where they are stout and acuminate on the entire movable finger and all but base of the fixed finger. Fixed finger with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 31); *eb* adjacent to *esb*; *est* slightly closer to *esb* than to *et*; *isb* inserted sub-dorsally, rather than internally or externally, and mid-way between *it* and *ist*; *ist* adjacent to *ib*; *sb* adjacent to *b*; *st* slightly closer to *t* than to *sb*. Venom apparatus present in movable finger with nodus ramosus terminating near *st* (Fig. 31). External margin of fixed chelal finger with 8–9 “sense spots,” internal margin of fixed chelal finger with 1 “sense spot,” and external margin of movable chelal finger with 2 “sense spots.”

Chelicera (Fig. 29): with 6 setae on hand; *ls*, *is* and *es* acuminate, *sbs*, *bs'* and *bs''* dentate; movable finger with 1 acuminate seta (*gs*); with 2 dorsal and 1 ventral lyrifissures. Movable finger with single dorsal tooth. Galea

long and slender with 5 small distal rami. Flagellum (Fig. 30) composed of 4 blades; anterior blade dentate along the anterior margin; remaining blades smooth. Serrula exterior with 16 (♂), 18 (♀) lamellae.

Cephalothorax: carapace (Fig. 24): 0.99–1.12 (♂), 0.96–1.06 (♀) times longer than wide; unicolored; eyes absent; with 4–6 (♂), 6 (♀) setae on anterior margin, with 16–20 (♂), 20 (♀) setae on posterior margin; posterior half with two narrow transverse furrows, anterior furrow crosses carapace at ca. 0.52 (♂), 0.58 (♀) of its length, posterior furrow crosses at ca. 0.83 (♂), 0.84 (♀) of carapace length; entirely granulate with exception of transverse furrows; posterior margin straight. Manducatory process with 1 long distal and 1 long sub-distal seta, with sub-oral seta; remainder of maxilla with 31 (♂), 42 (♀) setae. Chaetotaxy of coxae I–IV: 10: 10: 15: 28 (♂), 11: 16: 23: ca. 52 (♀).

Abdomen: tergites I and XI partially divided, tergites II–X (Fig. 4) and sternites IV–X fully divided. Tergal chaetotaxy: ♂, 17: 16: 19: 22: 24: 22: 23: 26: 24: 22: 20: 2; ♀, 18: 20: 19: 24: 25: 27: 28: 26: 28: 26: 22: 2; setae usually restricted to posterior and lateral tergal margins. Sternal chaetotaxy: ♂ ca. 60: (3) 24 [3+3] (3): (3) 7 (3): 13: 16: 16: 15: 16: 16: 14: 2; ♀, 60: (3) 8 (3): (4) 10 (3): 16: 18: 19: 21: 21: 13: 13: 2. Pleural membrane wrinkled plicate for entire length, without setae.



Genital region: male anterior genital operculum with setae long and curved (some reaching genital opening); one pair of slit sensilla on anterior and posterior opercula. Female genital opercula: anterior operculum with ca. 60 setae and 2 slit sensilla. Male genitalia of typical chernetid form (Vachon 1938). Female spermathecae with 2 thickened and curved tubes fusing near the genital operculum (Fig. 28).

Legs: legs I and II with an oblique junction between femur and patella. Leg IV (Fig. 27) with femur + patella 3.54 (♂), 3.13 (♀) times longer than broad. Tibiae and tarsi of legs III and IV without tactile setae. Tarsi with single raised slit sensillum. Tarsal claws simple; arolium slightly shorter than claws.

**Dimensions (mm).**—*Male from Yilliminning Agricultural Region, Western Australia (WAM T66301), with other specimens in parentheses, where appropriate:* Body length 2.78 (2.34–2.81). Pedipalps: trochanter 0.499/0.314 (0.424–0.520/0.265–0.352), femur 0.766/0.300 (0.656–0.846/0.295–0.347), patella 0.712/0.333 (0.642–0.780/0.314–0.378), chela (with pedicel) 1.408/0.485 (1.158–1.480/0.403–0.526), chela (without pedicel) 1.314 (1.088–1.406), hand length 0.614 (0.568–0.658), movable finger length 0.720 (0.614–0.768). Chelicera 0.300/0.174, movable finger length 0.214. Carapace 0.893/0.794 (0.800–0.904/0.736–0.912). Leg I: femur 0.268/0.175, patella 0.403/0.157, tibia 0.397/0.111, tarsus 0.365/0.074. Leg IV: femur + patella 0.726/0.205, tibia 0.557/0.125, tarsus 0.403/0.086.

*Female from Yilliminning Agricultural Region, Western Australia (WAM T66301), with female from Gin Gin Shire (WAM T48341) in parentheses, where appropriate:* Body length 3.05 (2.51). Pedipalps: trochanter 0.538/0.320 (0.511/0.326), femur 0.800/0.327 (0.768/0.301), patella 0.755/0.360 (0.720/0.333), chela (with pedicel) 1.418/0.507 (1.371/0.481), chela (without pedicel) 1.344 (1.307), hand length 0.661 (0.640), movable finger length 0.768 (0.664). Chelicera 0.320/0.159, movable finger length 0.243. Carapace 0.978/0.922 (0.862/0.896). Leg I: femur 0.269/0.192, patella 0.430/0.180, tibia 0.422/0.087, tarsus 0.371/0.083. Leg IV: femur + patella 0.736/0.235, tibia 0.582/0.134, tarsus 0.426/0.096.

*Tritonymphs:* Morphology generally as in

adults. Pedipalps, carapace, pedipalpal coxae and anterior half of coxa I red-brown, remainder of body pale red-yellow.

Chelicera: with 6 setae on hand, *ls*, *is* and *es* acuminate, *sbs*, *bs'* and *bs''* dentate; movable finger with 1 sub-distal seta (*gs*). Movable finger with single dorsal tooth. Galea long and slender with 5 small distal rami. Flagellum composed of 4 blades.

Pedipalp: trochanter 1.90, femur 2.35, patella 1.86, chela (with pedicel) 2.76, chela (without pedicel) 2.58, hand 1.35 times longer than wide, movable finger 0.96 times longer than hand. Fixed chelal finger with 7 trichobothria, movable chelal finger with 3 trichobothria (Fig. 32): *isb* and *sb* absent; *esb* situated near *eb*; *est* slightly closer to *esb* than to *et*; *ist* adjacent to *ib*; *st* closer to *sb* than to *t*, which is situated in distal third of movable finger. Venom apparatus present in movable finger with nodus ramosus terminating basal to *t* (Fig. 32). Chelal teeth: fixed finger with 33 marginal teeth, plus 9 external accessory teeth and 3 internal accessory teeth; movable finger with 37 marginal teeth, plus 7 external accessory teeth and 3 internal accessory teeth. External margin of fixed chelal finger with 3 "sense spots," internal margin of fixed chelal finger with 0 "sense spots," and external margin of movable chelal finger with 1 "sense spot."

Cephalothorax: carapace 1.03 times longer than wide; without eyes; with 4 setae on anterior margin and 15 setae on posterior margin; with two deep transverse furrows.

Abdomen: Tergites I–X and sternites III–X with medial suture line. Tergal chaetotaxy: 14: 16: 17: 20: 18: 19: 19: 20: 18: 17: 17: 2. Sternal chaetotaxy: 15: (1) 14 (1): (2) 6 (2): 10: 13: 14: 15: 15: 14: 15: 2. Pleural membrane uniformly wrinkled plicate, without setae.

Legs: legs I and II with an oblique junction between femur and patella. Tibiae and tarsi of legs III and IV without tactile setae. Tarsi with single raised slit sensillum. Tarsal claws simple; arolium slightly shorter than claws.

**Dimensions (mm).**—*Tritonymph from Yilliminning Agricultural Region, Western Australia (WAM T66301):* Body length 2.64. Pedipalps: trochanter 0.376/0.198, femur 0.664/0.282, patella 0.592/0.318, chela (with pedicel) 1.150/0.416, chela (without pedicel)

1.072, hand length 0.563, movable finger length 0.540. Carapace 0.816/0.792.

**Deutonymphs:** Morphology generally as in adults. Pedipalps and carapace lightly sclerotized, abdomen creamy yellow.

**Chelicera:** with 5 setae on hand, *ls*, *is*, *bs* and *es* acuminate, *sbs* dentate; movable finger with 1 sub-distal seta (*gs*). Movable finger with single dorsal tooth. Galea long and slender with 3 small distal rami. Flagellum composed of 4 blades.

**Pedipalp:** trochanter 1.69, femur 2.83, patella 1.92, chela (with pedicel) 2.99, chela (without pedicel) 2.85, hand 1.41 times longer than wide, movable finger 1.02 times longer than hand. Fixed chelal finger with 6 trichobothria, movable chelal finger with 2 trichobothria (Fig. 33): *esb*, *isb*, *sb* and *st* absent; *est* closer to *eb* than to *et*; *ist* adjacent to *ib*. Venom apparatus present in movable finger with nodus ramosus terminating basal to *t* (Fig. 33). Chelal teeth: fixed finger with 22 marginal teeth, plus 5 external accessory teeth and 3 internal accessory teeth; movable finger with 28 marginal teeth, plus 3 external accessory teeth and 2 internal accessory teeth. External margin of fixed chelal finger with 1 "sense spot," internal margin of fixed chelal finger with 0 "sense spots," and external margin of movable chelal finger with 1 "sense spot."

**Cephalothorax:** carapace 1.16 times longer than wide; without eyes; with 4 setae on anterior margin and 10 setae on posterior margin; with two shallow furrows.

**Abdomen:** Tergites I–X and sternites II–X with medial suture line. Tergal chaetotaxy: 10: 9: 10: 10: 10: 10: 10: 10: 10: 11: 2. Sternal chaetotaxy: 0: (1) 3 (1): (2) 4 (2): 8: 8: 9: 9: 8: 9: 7: 2. Pleural membrane uniformly wrinkled plicate, without setae.

**Legs:** legs I and II with an oblique junction between femur and patella. Tibiae and tarsi of legs III and IV without tactile setae. Tarsi with single raised slit sensillum. Tarsal claws simple; arolium slightly shorter than claws.

**Dimensions (mm).—Deutonymph from Yilliminning Agricultural Region, Western Australia (WAM T66301):** Body length 1.66. Pedipalps: trochanter 0.250/0.148, femur 0.438/0.155, patella 0.333/0.173, chela (with pedicel) 0.690/0.231, chela (without pedicel) 0.658, hand length 0.326, movable finger length 0.333. Carapace 0.544/0.467.

**Remarks.**—As discussed above, the morphology of the spermathecae and the presence of four flagellar blades indicates that this species cannot be retained in the genus *Sundochernes*. *Troglochernes dewae* has been collected solely from bird nests, including that of the Galah (*Cacatua roseicapilla*), Sulphur-Crested Cockatoo (*C. galerita*), Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and Rufous Treecreeper (*Climacteris rufa*). It has been recorded from many different parts of Australia (Fig. 71), making it the most widespread of any member of the genus *Troglochernes*.

***Troglochernes novaeguineae* (Beier 1965)**

new combination

Figs. 34–40, 71

*Sundochernes novaeguineae* Beier 1965:779–780, fig. 19; Beier 1982:44; Tenorio & Muchmore 1982:381; Harvey 1991:626; Beron 2002:38.

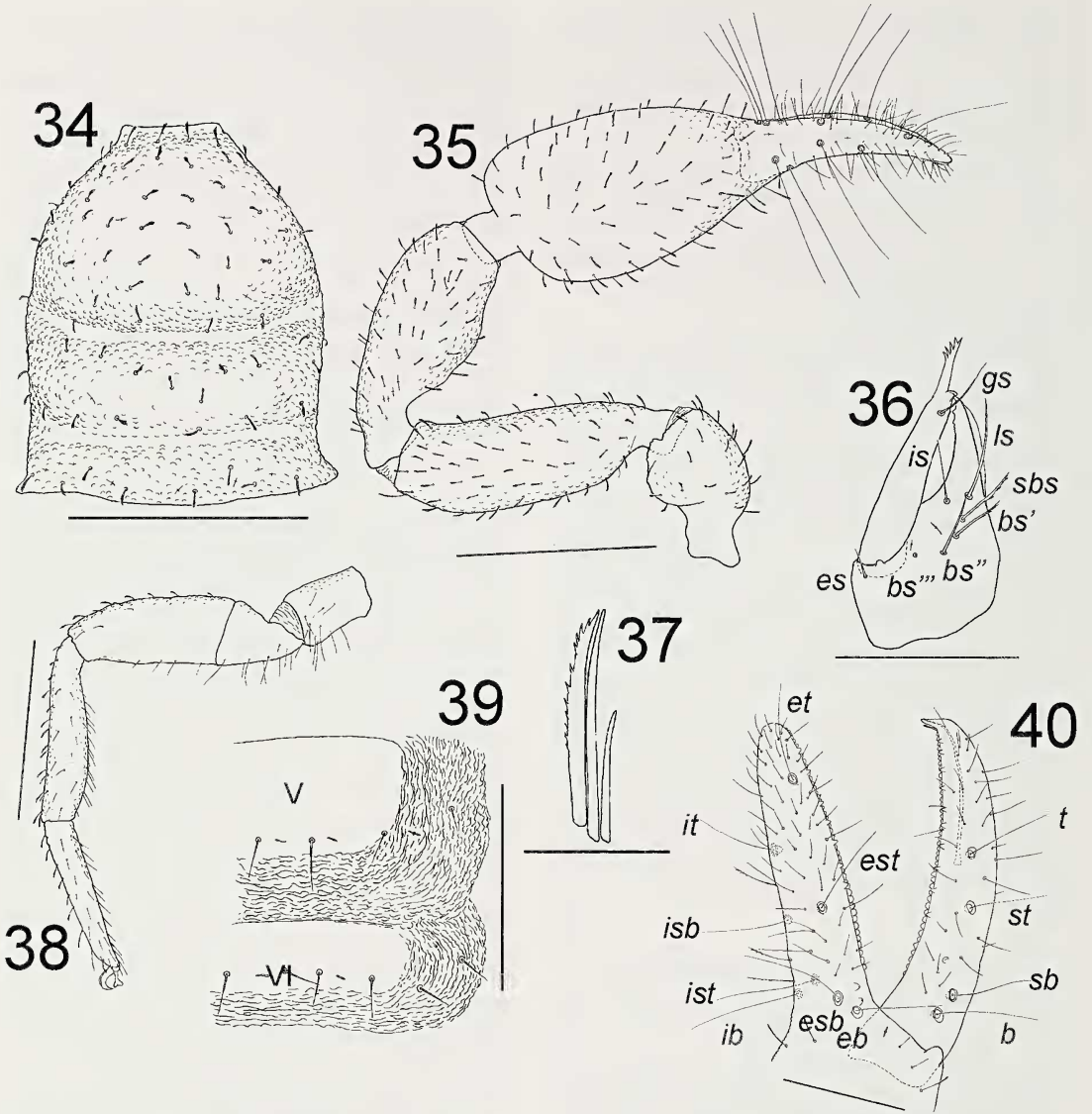
**Type material.**—PAPUA NEW GUINEA: Southern Highlands Province: Holotype female, Mt. Giluwe [6°06'S, 143°54'E], 2550 m, 28 May 1963, Sedlacek (BPBM 6268).

**Diagnosis.**—*Troglochernes novaeguineae* lacks the long, elongate pedipalps and legs characteristic of *T. imitans*, and differs from all other members of the genus by possessing more slender pedipalpal segments, e.g., female chelal patella 2.50 times longer than wide in *T. novaguineae* and 2.06–2.36 times longer than wide in other females of the genus. It also differs from other species of the genus by the presence of 1 or 2 setae situated within the pleural membrane adjacent to sternites V–IX (see Remarks below).

**Description.**—*Adult female:* Pedipalps and carapace dark red-brown; abdomen and legs light red-brown in color. Vestitural setae short, curved and strongly dentate; most sternal setae acicular with few dentate.

**Pedipalps** (Fig. 35): robust and densely setose, with trochanter 1.67, femur 3.27, patella 2.50, chela (with pedicel) 3.04, chela (without pedicel) 2.90, and hand 1.57 times longer than wide; movable finger 1.17 times longer than hand. All surfaces of pedipalp finely to heavily granulate with exception of chelal fingers. Fixed finger with 39 marginal teeth, plus 7 external accessory teeth and 3 internal accessory teeth; movable finger with 43 marginal teeth, plus 9 external accessory teeth and 1 internal accessory tooth. Pedipalpal setae stout, clavate-dentate and curved, except on





Figures 34–40.—*Trogloderes novaeguineae*, sp. nov., female holotype (BPBM 6268): 34. Carapace, dorsal; 35. Left pedipalp, dorsal; 36. Left chelicera; 37. Left flagellum; 38. Left leg IV; 39. Left sternites V–VI; 40. Right chelal fingers, lateral. Scale lines = 0.50 mm (Figs. 34, 35, 38), 0.20 mm (Figs. 36, 39, 40), 0.05 mm (37). See Methods for abbreviations.

fingers where they are stout and acuminate on the entire movable finger and all but base of the fixed finger. Fixed finger with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 40); *esb* closer to *eb* than to *est*; *est* closer to *esb* than to *et*; *isb* closer to *ist* than to *it*; *ist* closer to *ib* than to *isb*; *sb* closer to *b* than to *st*; *st* closer to *t* than to *sb*. Venom apparatus present in movable finger with nodus ramosus terminating adjacent to *st* (Fig. 40). External margin of fixed chelal finger

with 2 “sense spots,” internal margin of fixed chelal finger with 1 “sense spot,” and external margin of movable chelal finger with 1 “sense spot.”

Chelicera (Fig. 36): with 7 setae on hand; *es*, *ls* and *is* is acuminate, *sbs*, *bs'* and *bs''* dentate, morphology of *bs'''* unknown (lost from each chelicera); movable finger with 1 acuminate seta (*gs*); with 2 dorsal and 1 ventral lyrifissures. Movable finger with single dorsal tooth. Galea long and slender with 6 small

distal to sub-distal rami. Flagellum (Fig. 37) apparently composed of 3 blades (see below); anterior blades dentate along the distal anterior half; other blades smooth. Serrula exterior with 17 lamellae.

Cephalothorax: carapace (Fig. 34): 1.26 times as long as broad; unicolored; eyes absent; with 5 setae on anterior margin, with 8 setae on posterior margin; posterior half with two moderately incised transverse furrows, anterior furrow crosses the carapace at ca. 0.54 of its length, posterior furrow crosses at ca. 0.86 of carapace length; entirely granulate with exception of transverse furrows, and parts of metazone; posterior margin slightly curved. Manducatory process with 1 long distal and 1 long sub-distal seta, with sub-oral seta; remainder of maxilla with 22 setae. Chaetotaxy of coxae I–IV: 12: 15: 21: ca. 42.

Abdomen: tergites I–X and sternites V–X divided. Tergal chaetotaxy: 10: 12: 13: 17: 15: 14: 14: 14: 12: 10: 10: 2; setae usually restricted to posterior and lateral tergal margins. Sternal chaetotaxy: 24: (3) 13 (3): (2) 18 (2): 18: 19: 19: 14: 12: ? : ? : 2. Pleural membrane longitudinally striate for entire length, with 1 or 2 setae within the pleural membrane adjacent to sternites V–IX.

Female genital opercula: anterior operculum with numerous setae and 2 slit sensilla. Spermathecae not visible.

Legs: legs I and II with an oblique junction between femur and patella. Leg IV (Fig. 38) with femur + patella 5.08 times longer than wide. Tibiae and tarsi of legs III and IV without tactile setae. Tarsi with single raised slit sensillum. Tarsal claws simple; arolium slightly shorter than claws.

**Dimensions (mm).**—*Female holotype* (BPBM 6268): Body length 2.48. Pedipalps: trochanter 0.406/0.243, femur 0.752/0.230, patella 0.655/0.262, chela (with pedicel) 1.227/0.403, chela (without pedicel) 1.168, hand length 0.634, movable finger length 0.541. Chelicera 0.282/0.154, movable finger length 0.201. Carapace 0.786/0.624. Leg I: femur 0.217/0.144, patella 0.338/0.127, tibia 0.348/0.090, tarsus 0.381/0.067. Leg IV: femur + patella 0.665/0.131, tibia 0.529/0.114, tarsus 0.450/0.084.

**Remarks.**—Beier (1965) described *Sundochernes novaeguineae* from a single female specimen collected from central Papua New Guinea (Fig. 71) and later recorded *S. novae-*

*guineae* based upon material taken from an unspecified Papuan locality (Beier 1982). Although we were able to only study the female holotype, we found that it possesses several features that suggest it is better placed in *Troglochernes* than in *Sundochernes*. It lacks eye-spots that are found in *Sundochernes*, and bears 1 or 2 setae within the pleural membrane adjacent to sternites V–IX. The only other species of *Troglochernes* with a similar condition is the female of *T. cruciatus* which bears a single seta adjacent to sternite V (Fig. 39). This feature may attest to a common ancestry between these two species which is supported by their geography as *T. novaeguineae* occurs in central Papua New Guinea and *T. cruciatus* in north-eastern Australia (Fig. 71). The permanent slide preparation of this specimen has obscured the morphology of the spermathecae, and the chelicerae are poorly positioned so that the number of flagellar blades is difficult to ascertain with any confidence. Our examination suggests that only three blades are present (Fig. 37) but additional specimens should be examined to obtain an accurate count.

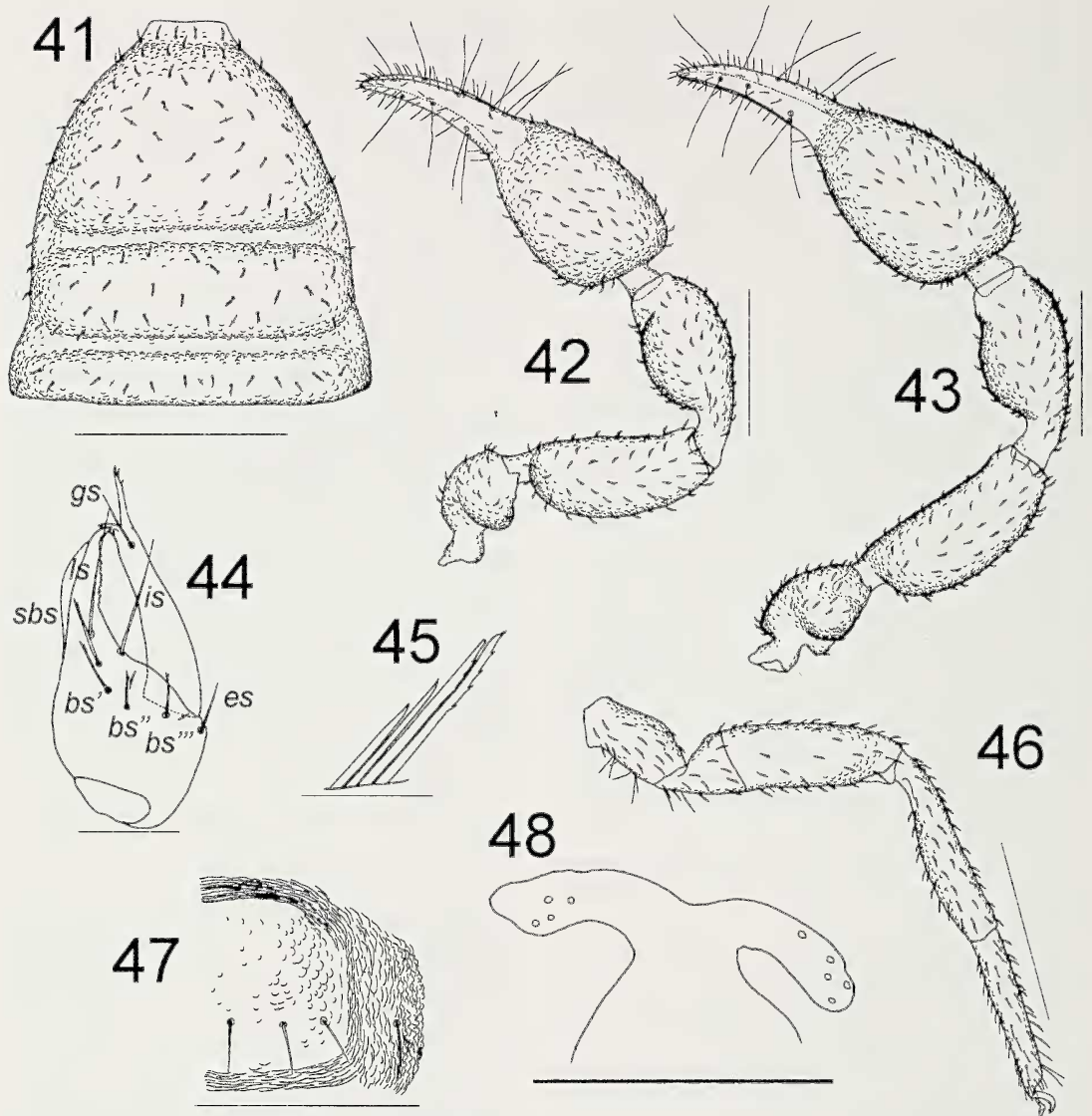
### *Troglochernes cruciatus* Volschenk

new species

Figs. 5, 41–52, 71

**Type material.**—AUSTRALIA: *Queensland*: Holotype female, back of Rope Ladder Cave, in dark zone, Fanning River Station, 19°45'S, 146°28'E, under rocks and in bat guano, 18 March 1995, E.S. Volschenk, D. Slaney (MTQ S105893). Paratypes: 10 males, 9 females, 8 tritonymphs, 6 deutonymphs, 2 protonymphs, collected with holotype (MTQ S105894–S105928); 12 males, 11 females, 10 tritonymphs, 8 deutonymphs, 2 protonymphs, collected with holotype (QM S74360–74402); 8 males, 10 females, 7 tritonymphs, 2 deutonymphs, 1 protonymph, collected with holotype (WAM T75430–75451); 1 male, 1 female, 1 tritonymph, 1 deutonymph, 1 protonymph, collected with holotype (SAM PS1363–1367); 1 male, 1 female, 1 tritonymph, 1 deutonymph, 1 protonymph, collected with holotype (AM KS96109–96113); 1 male, 1 female, 1 tritonymph, 1 deutonymph, 1 protonymph, collected with holotype (NMV K-9870–9874); 1 male, 1 female, 1 tritonymph, 1 deutonymph, 1 protonymph, collected with holotype (ANIC); 1 male, 1 fe-

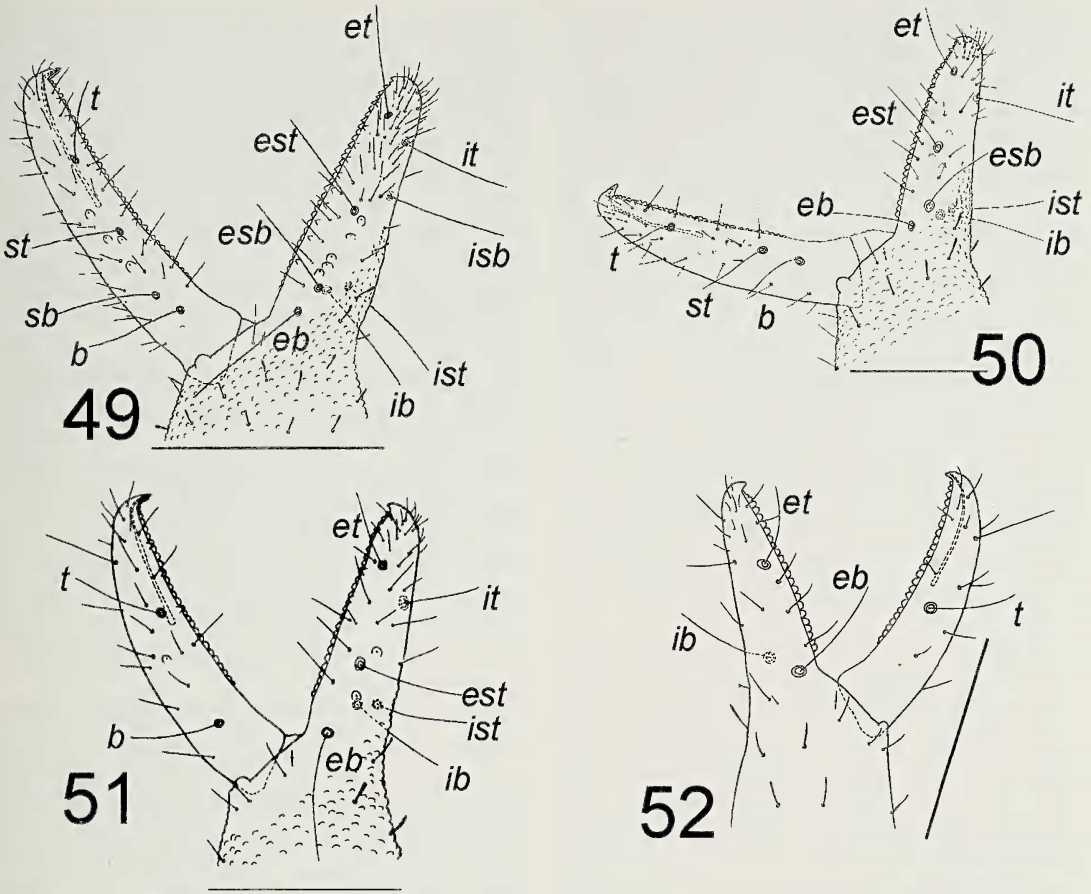




Figures 41–48.—*Troglochernes cruciatus*, sp. nov., female holotype (MTQ) unless stated otherwise: 41. Carapace; 42. Right pedipalp, dorsal; 43. Right pedipalp, dorsal male paratype (MTQ); 44. Right chelicera; 45. Left flagellum; 46. Left leg IV; 47. Left sternite V; 48. Spermathecae. Scale lines = 0.50 mm (Figs. 41–43, 46), 0.20 mm (Fig. 47), 0.10 mm (Figs. 44, 48), 0.05 mm (Fig. 45). See Methods for abbreviations.

male, 1 tritonymph, 1 deutonymph, 1 protonymph, collected with holotype (AMNH); 1 male, 1 female, 1 tritonymph, 1 deutonymph, 1 protonymph, collected with holotype (BMNH); 1 male, 1 female, 1 tritonymph, 1 deutonymph, 1 protonymph, collected with holotype (MNHN); 1 male, 1 female, 1 tritonymph, 1 deutonymph, 1 protonymph, collected with holotype (MHNG); 1 male, 6 fe-

males, Rope Ladder Cave, 22 August 1993, P. Weinstein (WAM T68621).  
**Etymology.**—The specific epithet *cruciatus*, is Latin for torture or torment, and is used in reference to the junior authors' honors year (1995), during which this species was discovered and studied.  
**Diagnosis.**—*Troglochernes cruciatus* differs from *T. imitans* in the lack of long slender



Figures 49–52.—*Trogloderes cruciatus*, sp. nov., chelal fingers: 49. Left chelal fingers, lateral, female holotype (MTQ); 50. Left chelal fingers, lateral, tritonymph paratype (MTQ); 51. Left chelal fingers, lateral, deutonymph paratype (MTQ); 52. Right chelal fingers, lateral, protonymph paratype (MTQ). Scale lines = 0.50 mm (Fig. 52), 0.40 mm (Fig. 49), 0.20 mm (Figs. 50, 51). See Methods for abbreviations.

appendages, from *T. guanophilus*, *T. dewae* and *T. omorgus* in the number of setae on the posterior margin of the carapace (14–16 in *T. cruciatus* and 10–12 in *T. guanophilus*, 10 in *T. dewae* and 25 in *T. omorgus*), and from *T. novaeguineae* by the more robust pedipalpal patella (2.06–2.36 times longer than wide in female *T. cruciatus*, and 2.62 in *T. novaeguineae*). Females differ from all other species by the presence of a seta situated within the pleural membrane adjacent to sternite V; other species either lack such a seta (*T. imitans*, *T. guanophilus*, *T. dewae* and *T. omorgus*) or possess 1 or 2 similar setae adjacent to sternites V–IX (*T. novaeguineae*).

**Description.**—*Adults*: Pedipalps and carapace reddish-brown; abdomen and legs light yellowish brown in color. Vestitural setae

short, slightly curved, and dentate; most sternal setae acicular with few dentate.

**Pedipalps** (Figs. 42, 43): robust, with trochanter 1.48–1.79 (♂), 1.41–1.81 (♀), femur 2.40–2.98 (♂), 2.43–2.92 (♀), patella 2.04–2.34 (♂), 2.06–2.36 (♀), chela (with pedicel) 2.66–3.00 (♂), 2.45–2.98 (♀), chela (without pedicel) 2.25–2.86 (♂), 2.39–3.10 (♀) times longer than wide; movable finger 0.35–0.55 (♂), 0.42–0.56 (♀) times the length of the chela (with pedicel). All surfaces of pedipalp finely to heavily granulate with exception of distal half of fixed chelal finger, and entire movable finger. Fixed finger with 33–37 (♂, ♀) marginal teeth, plus 9–12 external accessory teeth and 4–5 (♂, ♀) internal accessory teeth; movable finger with 34–39 (♂), 35–41 (♀), marginal teeth, plus 8–11 (♂), 7–11 (♀)



external accessory teeth and 3–4 internal accessory teeth. Pedipalpal setae stout and clavate-dentate, except on fingers where they are stout and acuminate on the entire movable finger and all but base of the fixed finger. Fixed finger with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 49); *esb* closer to *eb* than to *est*; *est* closer to *esb* than to *et*, which is situated in distal quarter of fixed finger; *isb* inserted dorsally, rather than internally or externally, and closer to *it* than to *ist*; *ist* closer to *ib* than to *isb*; *sb* closer to *b* than to *st*; *st* closer to *sb* than to *t*, which is situated in distal third of movable finger. Venom apparatus present in movable finger with nodus ramosus terminating midway between *t* and *st* (Fig. 49). External margin of fixed chelal finger with 5 "sense spots," internal margin of fixed chelal finger with 3 "sense spots," and external margin of movable chelal finger with 3 "sense spots."

Chelicera (Fig. 44): with 6–7 setae on hand; *ls*, *is* and *es* acuminate, *sbs*, *bs'*, *bs''* and *bs'''* (when present) dentate; movable finger with 1 acuminate seta (*gs*); with 2 dorsal and 1 ventral lyrifissures. Movable finger with single dorsal tooth. Galea long and slender with 5–6 rami, extending past tip of movable finger by 0.21–0.32 ( $\delta$ ), 0.30–0.40 ( $\varphi$ ) times length of movable finger. Flagellum (Fig. 45) composed of 4 blades; longest two blades dentate along the distal anterior half; two shorter blades smooth. Serrula exterior with 18 lamellae.

Cephalothorax: carapace (Fig. 41): 0.93–1.42 ( $\delta$ ), 0.87–1.23 ( $\varphi$ ) times as long as broad; unicolored; eyes absent; with 4–6 setae on anterior margin, with 15–19 ( $\delta$ ), 15–19 ( $\varphi$ ) setae on posterior margin; posterior half with two moderately incised transverse furrows, anterior furrow crosses the carapace at 0.56 of its length, posterior furrow crosses at 0.80 of carapace length; entirely granulate with exception of transverse furrows; posterior margin straight. Manducatory process with 1 long distal and 1 long sub-distal seta, with sub-oral seta; remainder of maxilla with 24 ( $\delta$ ), 29 ( $\varphi$ ) setae. Chaetotaxy of coxae I–IV: 16: 20: 24: 44 ( $\delta$ ), 19: 24: 30: ca. 55 ( $\varphi$ ).

Abdomen: tergites I–X (Fig. 5) and sternites IV–X ( $\delta$ ), III–X ( $\varphi$ ) divided. Tergal chaetotaxy:  $\delta$ , 16–19: 17–20: 17–21: 22–24: 22–24: 22–25: 21–25: 22–25: 21–23: 19–22: 18–22: 2;  $\varphi$ , 15–18: 16–19: 18–21: 23–26:

23–26: 22–26: 23–27: 21–26: 20–22: 18–22: 20–21: 2; setae usually restricted to posterior and lateral tergal margins. Sternal chaetotaxy:  $\delta$ , 53–67: (2–3) 23–29 [4–7] (2–3): (2–3) 14–16 (2–3): 18–21: 19–23: 18–21: 16–21: 16–19: 16–17: 10–15: 2;  $\varphi$  (excluding seta adjacent to sternite V), 37–58: (3) 15–21 (3): (3) 14–16 (3): 15–18: 18–20: 18–20: 18–20: 17–19: 15–17: 10–14: 2. Pleural membrane longitudinally striate for entire length with one seta adjacent to sternite V in  $\varphi$ .

Genitalia: male genital opercula with setae on posterior region, long and curved (some reaching the genital opening), anterior setae are shorter and curved; one pair of slit sensilla on anterior and posterior operculum, posterior operculum with smaller sensilla. Female genital opercula: anterior operculum with numerous setae and 2 slit sensilla. Male genitalia of typical chernetid form (Vachon 1938). Female spermathecae with 2 thickened and slightly curved tubes fusing near the genital operculum (Fig. 48).

Legs: legs I and II with an oblique junction between femur and patella. Leg IV (Fig. 46) with femur + patella 3.77 ( $\delta$ ), 3.72 ( $\varphi$ ) times longer than broad. Tibiae and tarsi of legs III and IV without tactile setae. Tarsi with single raised slit sensillum. Tarsal claws simple; arolium slightly shorter than claws.

**Dimensions (mm).**—*Male paratype from Rope Ladder Cave, Queensland (MTQ), with other specimens (n = 29) in parentheses, where appropriate:* Body length 2.60. Pedipalps: trochanter 0.497/0.256 (0.37–0.47/0.21–0.29), femur 0.784/0.282 (0.64–0.80/0.25–0.33), patella 0.693/0.303 (0.51–0.75/0.25–0.33), chela (with pedicel) 1.250/0.424 (1.02–1.34/0.38–0.49), chela (without pedicel) 1.192 (1.05–1.35), hand length 0.604, movable finger length 0.603 (0.42–0.63). Chelicera 0.267/0.140 (0.24–0.28/0.10–0.15), movable finger length 0.197 (0.14–0.20). Carapace 0.819/0.462 (0.80–0.93/0.57–0.91). Leg I: femur 0.237/0.121 (0.21–0.29/0.13–0.16), patella 0.371/0.131 (0.27–0.40/0.11–0.14), tibia 0.383/0.096 (0.28–0.42/0.08–0.10), tarsus 0.384/0.070 (0.30–0.40/0.06–0.08). Leg IV: femur + patella 0.648/0.172, femur 0.249/0.159 (0.20–0.26/0.13–0.17), patella 0.456/0.172 (0.35–0.51/0.14–0.18), tibia 0.522/0.113 (0.40–0.59/0.10–0.12), tarsus 0.447/0.077 (0.33–0.53/0.07–0.09).

*Female holotype from Rope Ladder Cave,*

*Queensland (MTQ)*, with other specimens ( $n = 30$ ) in parentheses, where appropriate: Body length 2.80. Pedipalps: trochanter 0.480/0.269 (0.31–0.49/0.22–0.30), femur 0.800/0.293 (0.64–0.82/0.24–0.32), patella 0.746/0.328 (0.52–0.77/0.21–0.35), chela (with pedicel) 1.349/0.461 (1.05–1.40/0.37–0.49), chela (without pedicel) 1.292 (0.92–1.29), hand length 0.656, movable finger length 0.640 (0.48–0.69). Chelicera 0.283/0.116 (0.22–0.30/0.12–0.16), movable finger length 0.211 (0.12–0.20). Carapace 0.902/0.861 (0.80–0.95/0.60–0.95). Leg I: femur 0.230/0.149 (0.19–0.30/0.12–0.17), patella 0.342/0.130 (0.28–0.40/0.11–0.14), tibia 0.378/0.093 (0.37–0.44/0.08–0.11), tarsus 0.384/0.071 (0.30–0.43/0.06–0.08). Leg IV: femur + patella 0.692/0.186, femur 0.261/0.171 (0.20–0.27/0.13–0.17), patella 0.500/0.186 (0.35–0.53/0.15–0.19), tibia 0.557/0.110 (0.47–0.60/0.09–0.12), tarsus 0.469/0.078 (0.40–0.49/0.07–0.09).

*Tritonymphs*: Morphology generally as in adults. Pedipalps, carapace, pedipalpal coxae and anterior half of coxa I red-brown, remainder of body pale red-yellow.

Chelicera: with 6 setae on hand, *ls*, *is* and *es* acuminate, *sbs*, *bs'* and *bs''* dentate; movable finger with 1 sub-distal seta (*gs*). Movable finger with single dorsal tooth. Galea long and slender with 4–5 small distal to sub-distal rami. Flagellum composed of 4 blades.

Pedipalp: trochanter 1.45–1.71, femur 2.30–2.60, patella 1.91–2.18, chela (with pedicel) 2.63–3.23, chela (without pedicel) 2.41–3.00 times longer than wide. Fixed chelal finger with 7 trichobothria, movable chelal finger with 3 trichobothria (Fig. 50): *isb* and *sb* absent; *esb* situated near *eb*; *est* slightly closer to *esb* than to *et*; *ist* adjacent to *ib*; *st* closer to *sb* than to *t*, which is situated in distal third of movable finger. Chelal teeth: fixed finger with 32 marginal teeth, plus 5 external accessory teeth and 2 internal accessory teeth; movable finger with 31 marginal teeth, plus 5 external accessory teeth and 2 internal accessory teeth. Venom apparatus present in movable finger with nodus ramosus terminating basal to *t* (Fig. 50). External margin of fixed chelal finger with 2 “sense spots,” internal margin of fixed chelal finger with 1 “sense spot,” and external margin of movable chelal finger with 3 “sense spots.”

Cephalothorax: carapace 0.98–1.34 times

longer than wide; without eyes; with 4 setae on anterior margin and 12 setae on posterior margin; with two deep furrows.

Abdomen: Tergites I–X and sternites III–X with medial suture line. Tergal chaetotaxy: 13: 12: 12: 14: 15: 17: 16: 17: 16: 13: 12: 2. Sternal chaetotaxy: 12: (2) 8 (2): (3) 8 (3): 10: 13: 13: 13: 10: 10: 8: 2. Pleural membrane uniformly wrinkled plicate, with 1 setae situated at junction of sternite V and pleural membrane.

Legs: legs I and II with an oblique junction between femur and patella. Tibiae and tarsi of legs III and IV without tactile setae. Tarsi with single raised slit sensillum. Tarsal claws simple; arolium slightly shorter than claws.

**Dimensions (mm).**—*Tritonymphs* ( $n = 30$ ) from Rope Ladder Cave, *Queensland (MTQ)*: Body length 1.96. Pedipalps: trochanter 0.29–0.37/0.19–0.24, femur 0.50–0.58/0.20–0.24, patella 0.45–0.55/0.21–0.27, chela (with pedicel) 0.86–1.00/0.29–0.37, chela (without pedicel) 0.79–0.94, movable finger length 0.38–0.47. Carapace 0.62–0.75/0.47–0.75.

*Deutonymphs*: Morphology generally as in adults. Pedipalps and carapace lightly sclerotized, abdomen creamy white.

Chelicera: with 5 setae on hand, *ls*, *is* and *es* acuminate, *sbs* and *bs* dentate; movable finger with 1 sub-distal seta (*gs*). Movable finger with single dorsal tooth. Galea long and slender with 3 small distal rami. Flagellum composed of 4 blades.

Pedipalp: trochanter 1.47–1.89, femur 2.28–2.71, patella 1.88–1.05, chela (with pedicel) 2.73–3.31, chela (without pedicel) 2.73–3.31 times longer than wide. Fixed chelal finger with 6 trichobothria, movable chelal finger with 2 trichobothria (Fig. 51): *esb*, *isb*, *sb* and *st* absent; *est* closer to *eb* than to *et*; *ist* adjacent to *ib*. Chelal teeth: fixed finger with 26 marginal teeth, plus 3 external accessory teeth and 2 internal accessory teeth; movable finger with 26 marginal teeth, plus 3 external accessory teeth and 1 internal accessory teeth. Venom apparatus present in movable finger with nodus ramosus terminating basal to *t* (Fig. 51). External margin of fixed chelal finger with 2 “sense spots,” internal margin of fixed chelal finger with 0 “sense spots,” and external margin of movable chelal finger with 2 “sense spots.”

Cephalothorax: carapace 0.81–1.30 times longer than wide; without eyes; with 4 setae



on anterior margin and 7 setae on posterior margin; with two shallow furrows.

Abdomen: Tergites I–X and sternites II–X with medial suture line. Tergal chaetotaxy: 10: 10: 10: 10: 10: 10: 11: 11: 10: 10: 10: 2. Sternal chaetotaxy: 0: (1) 5 (1): (2) 6 (2): 10: 9: 10: 10: 10: 10: 6: 2. Pleural membrane uniformly wrinkled plicate, with 1 setae situated at junction of sternite V and pleural membrane.

Legs: legs I and II with an oblique junction between femur and patella. Tibiae and tarsi of legs III and IV without tactile setae. Tarsi with single raised slit sensillum. Tarsal claws simple; arolium slightly shorter than claws.

**Dimensions (mm).**—*Deutonymphs* ( $n = 26$ ) from Rope Ladder Cave, Queensland (MTQ): Body length 1.41. Pedipalps: trochanter 0.21–0.26/0.13–0.16, femur 0.34–0.41/0.14–0.16, patella 0.32–0.37/0.16–0.18, chela (with pedicel) 0.61–0.71/0.20–0.23, chela (without pedicel) 0.58–0.66, movable finger length 0.24–0.33. Carapace 0.45–0.57/0.34–0.55.

*Protonymphs*: Morphology generally as in adults. Pedipalps and carapace pale yellow, abdomen white.

Chelicera: with 4 setae on hand, *ls*, *is* and *es* acuminate, *bs* dentate; movable finger without seta. Movable finger apparently without dorsal tooth. Galea long and slender with 2 small distal and 1 small sub-distal rami. Flagellum composed of 4 blades.

Pedipalp: trochanter 1.54–1.81, femur 2.02–2.60, patella 1.49–2.08, chela (with pedicel) 2.84–3.34, chela (without pedicel) 2.60–3.14 times longer than wide. Fixed chelal finger with 3 trichobothria, movable chelal finger with 1 trichobothrium (Fig. 52): *esb*, *est*, *isb*, *ist*, *it*, *b*, *sb* and *st* absent; *et* situated sub-distally, *eb* and *ib* situated basally, and *t* situated medially. Chelal teeth: fixed finger with 23 marginal teeth; movable finger with 25 marginal teeth; both fingers without external accessory teeth. Venom apparatus present in movable finger with nodus ramosus terminating distal to *t* (Fig. 52). External margin of chelal fingers without “sense spots.”

Cephalothorax: carapace 0.83–1.22 times longer than wide; without eyes; with 2 setae on anterior margin and 6 setae on posterior margin; with two very shallow furrows.

Abdomen: Tergites I–X and sternites II–X with medial suture line. Tergal chaetotaxy: 6:

6: 6: 6: 7: 6: 6: 6: 6: 6: 6: 2. Sternal chaetotaxy: 0: (1) 2 (1): (1) 4 (1): 6: 6: 6: 6: 6: 6: 4: 2. Pleural membrane uniformly wrinkled plicate, with 1 setae situated at junction of sternite V and pleural membrane.

Legs: legs I and II with an oblique junction between femur and patella. Tibiae and tarsi of legs III and IV without tactile setae. Tarsi without single raised slit sensillum. Tarsal claws simple; arolium slightly shorter than claws.

**Dimensions (mm).**—*Protonymphs* ( $n = 15$ ) from Rope Ladder Cave, Queensland (MTQ): Body length 1.26. Pedipalps: trochanter 0.16–0.20/0.10–0.12, femur 0.21–0.29/0.10–0.12, patella 0.21–0.25/0.11–0.14, chela (with pedicel) 0.45–0.51/0.15–0.18, chela (without pedicel) 0.42–0.48, movable finger length 0.20–0.24. Carapace 0.31–0.44/0.36–0.49.

**Remarks.**—The type and only known locality of *T. cruciatus* is Rope Ladder Cave, on Fanning River Station, about 70 km southwest of Townsville, northern Queensland (Fig. 71). The Fanning River karst contains numerous caves, all of which are dry limestone solution caves. The surface ranges from open karst with no cover to karst covered in thick vine thicket. With the exception of Maternity Cave, which was inaccessible owing to its treacherous nature, all the local caves were thoroughly searched but only Rope Ladder Cave was found to support *T. cruciatus*.

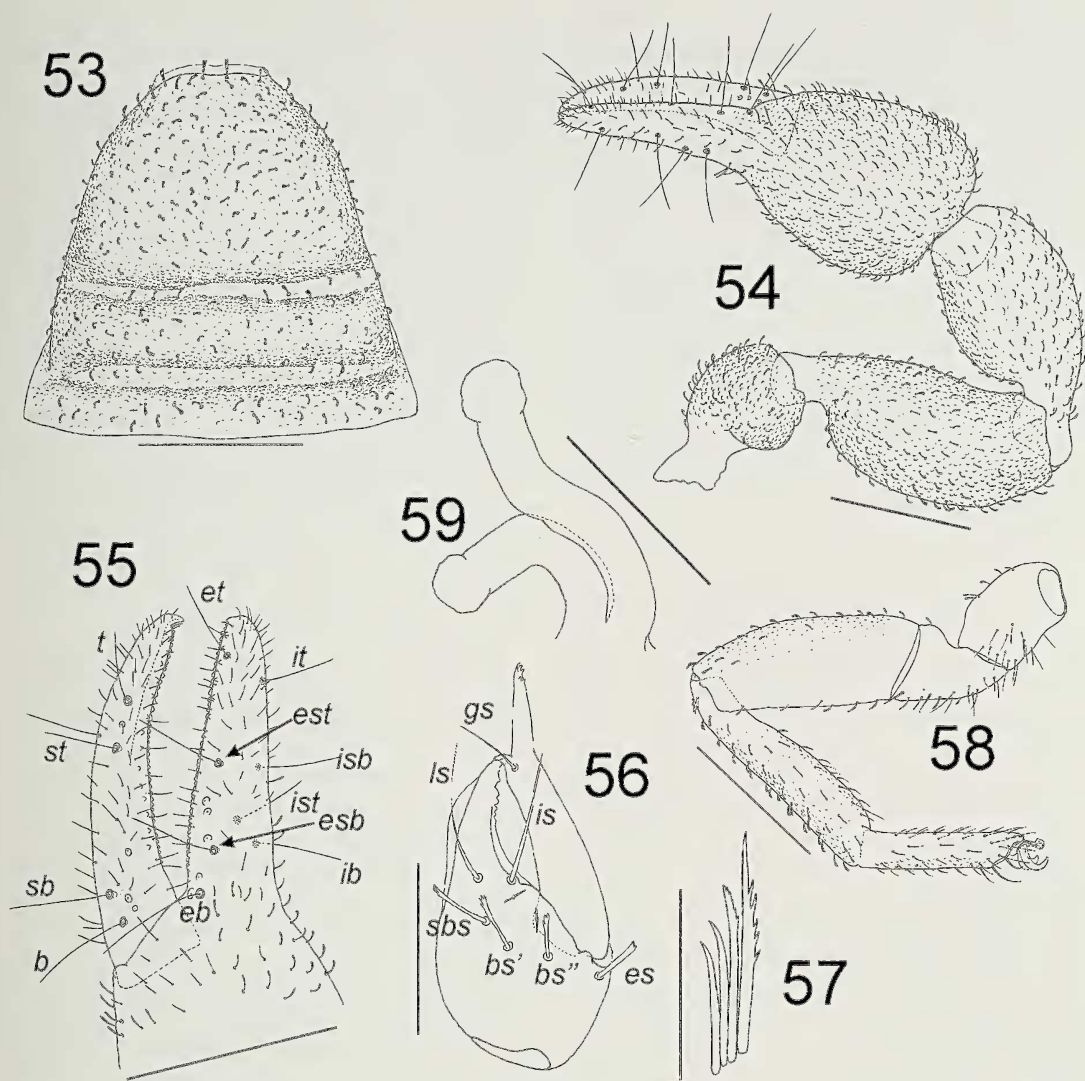
While having an extremely limited range, the species is very abundant and specimens were found in the dark zone (sensu Howarth 1988) under moist rocks, in bat guano and in leaf litter inside the cave (Weinstein & Slaney 1995). The caves are inhabited by Common Bent-Wing Bats, *Miniopterus schreibersii* (Kuhl), and Little Bent-Wing Bats, *M. australis* (Tomes), which excrete large quantities of droppings that accumulate into guano deposits.

### *Troglochernes omorgus*

Harvey & Volschenk new species

Figs. 53–59, 71

**Type material.**—AUSTRALIA: Queensland: Holotype female, Carnarvon National Park, Mt. Moffatt ranger's house [25°03'S, 148°03'E], from beetle [Trogidae, *Omorgus costatus* (Wiedemann)] at light, 24 November 1999, J.T. Jennings (QM S74354).



Figures 53–59.—*Troglochernes omorgus*, sp. nov., female holotype (QM): 53. Carapace, dorsal; 54. Right pedipalp, dorsal; 55. Left chelal fingers, lateral; 56. Right chelicera; 57. Right flagellum; 58. Left leg IV; 59. Spermathecae. Scale lines = 0.50 mm (Figs. 53, 54, 58), 0.20 mm (Fig. 56), 0.10 mm (Figs. 57, 59). See Methods for abbreviations.

**Etymology.**—The specific epithet refers to the beetle genus *Omorgus*, from which the holotype was found to be associated.

**Diagnosis.**—*Troglochernes omorgus* differs from other species of the genus by the greater number of setae on the carapace and tergites.

**Description.**—*Adult female*: Pedipalps and carapace dark red-brown; abdomen and legs light red-brown in color. Vestitural setae short, curved and strongly dentate; most sternal setae acicular with few dentate.

**Pedipalps** (Fig. 54): very robust and densely setose, with trochanter 1.61, femur 2.41, patella 2.07, chela (with pedicel) 2.67, chela (without pedicel) 2.48, and hand 1.09 times longer than wide; movable finger 1.27 times longer than hand. All surfaces of pedipalp finely to heavily granulate with exception of distal half of fixed chelal finger, and entire movable finger. Fixed finger with 42 marginal teeth, plus 15 external accessory teeth and 8 internal accessory teeth; movable finger with 46 marginal teeth, plus 15 external accessory



teeth and 6 internal accessory teeth. Pedipalpal setae stout, clavate-dentate and curved, except on fingers where they are stout and acuminate on the entire movable finger and all but base of the fixed finger. Fixed finger with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 55); *esb* closer to *eb* than to *est*; *est* closer to *esb* than to *et*; *isb* closer to *ist* than to *it*; *ist* closer to *ib* than to *isb*; *sb* closer to *b* than to *st*; *st* closer to *t* than to *sb*. Venom apparatus present in movable finger with nodus ramosus terminating adjacent to *st* (Fig. 55). External margin of fixed chelal finger with 10 "sense spots," internal margin of fixed chelal finger with 18 "sense spots" (mostly placed basal to *ib* and *ist*), and external margin of movable chelal finger with 4 "sense spots."

Chelicera (Fig. 56): with 6 setae on hand; *ls* and *is* acuminate, *es*, *sbs*, *bs'* and *bs''* dentate; movable finger with 1 acuminate seta (*gs*); with 2 dorsal and 1 ventral lyrifissures. Movable finger with single dorsal tooth. Galea long and slender with 6 small distal rami. Flagellum (Fig. 57) composed of 4 blades; longest two blades dentate along the distal anterior half; two shorter blades smooth. Serrula exterior with 21 lamellae.

Cephalothorax: carapace (Fig. 53): 1.08 times as long as broad; unicolored; eyes absent; with 7 setae on anterior margin, with 25 setae on posterior margin; posterior half with two moderately incised transverse furrows, anterior furrow crosses the carapace at ca. 0.6 of its length, posterior furrow crosses at ca. 0.85 of carapace length; entirely granulate with exception of transverse furrows; posterior margin slightly curved. Manducatory process with 1 long distal and 1 long sub-distal seta, with sub-oral seta; remainder of maxilla with ca. 70 setae. Chaetotaxy of coxae I-IV: 24: 29: 32: 64.

Abdomen: tergites II-X and sternites III-X divided, and tergite XI partially divided. Tergal chaetotaxy: 30: 32: 34: 38: 43: 46: 41: 43: 40: 33: 27: 2; setae usually restricted to posterior and lateral tergal margins. Sternal chaetotaxy: 62: (3) 27 (4): (4) 13 (4): 23: 28: 30: 29: 28: 30: 17: 2. Pleural membrane longitudinally striate for entire length, without setae.

Female genital opercula: anterior operculum with numerous setae and 2 slit sensilla. Spermathecae with 2 long, thickened and

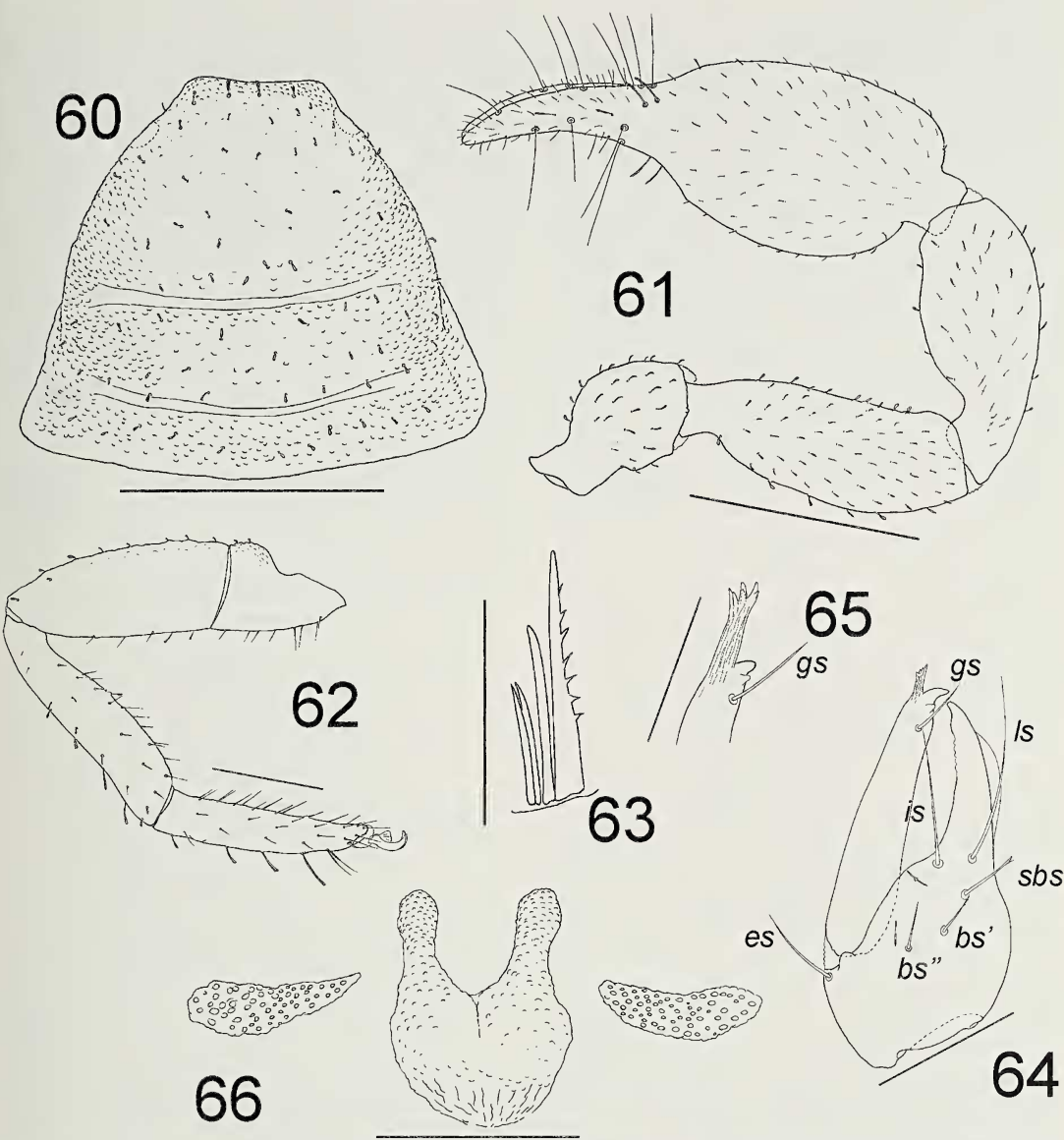
slightly curved tubes fusing near the genital operculum and slightly thickened distally (Fig. 59).

Legs: legs I and II with an oblique junction between femur and patella. Leg IV (Fig. 58) with femur + patella 3.44 times longer than wide. Tibiae and tarsi of legs III and IV without tactile setae. Tarsi with single raised slit sensillum. Tarsal claws simple; arolium slightly shorter than claws.

**Dimensions (mm).**—*Female holotype (QM)*: Body length 3.74. Pedipalps: trochanter 0.614/0.381, femur 1.066/0.442, patella 0.996/0.467, chela (with pedicel) 1.606/0.602, chela (without pedicel) 1.491, hand length 0.656, movable finger length 0.832. Chelicera 0.354/0.206, movable finger length 0.266. Carapace 1.136/1.054. Leg I: femur 0.323/0.225, patella 0.538/0.210, tibia 0.531/0.141, tarsus 0.434/0.099. Leg IV: femur + patella 1.005/0.292, tibia 0.798/0.173, tarsus 0.506/0.116.

**Remarks.**—*Troglochernes omorgus* is placed in the *Troglochernes* as it has four flagellar blades, lacks tactile setae on tarsi III and IV, lacks eyes or eyespots, has a unicolored carapace with two transverse furrows, and small, dentate, clavate vestitural setae. The spermathecae, however, are slightly different in morphology to those of other species of the genus, as they are oriented anteriorly (Fig. 59) rather than projecting laterally (Figs. 14, 23, 28, 48). While it is currently preferable to refer *T. omorgus* to *Troglochernes* rather than establish a separate monotypic genus, we suggest that the generic position of *T. omorgus* should be tested when further chernetids of this complex are discovered and analyzed.

The only known specimen of *T. omorgus* was found attached to a beetle of the family Trogidae, *Omorgus costatus* (Wiedemann) in south-eastern Queensland (Fig. 71). This beetle species is widely distributed throughout Australia, as well as Papua New Guinea, the Solomon Islands, Indonesia and the Asian mainland, and has been recorded from several different cave systems where it breeds in bat guano (Scholtz 1986). The presence of the pseudoscorpion on the beetle may simply be fortuitous, but may also signify that *T. omorgus* occurs in subterranean habitats like many of its congeners, and was collected while undertaking a phoretic journey after the beetle left the cave. Phoretic associations between pseudoscorpions and other animals, including



Figures 60–66.—*Satrapanus grayi* (Beier 1975), specimens from Lord Howe Island, female (AM) unless stated otherwise: 60. Carapace; 61. Right pedipalp, dorsal; 62. Left leg IV; 63. Left flagellum, male (AM); 64. Left chelicera, male (AM); 65. Detail of tip of movable cheliceral finger; 66. Spermathecae. Scale lines = 0.50 mm (Figs. 60, 61), 0.20 mm (Fig. 62), 0.10 mm (Figs. 64–66), 0.05 mm (Fig. 63). See Methods for abbreviations.

insects, are not uncommon (e.g., Beier 1948; Muchmore 1971; Poinar et al. 1998; Vachon 1940).

**Genus *Satrapanus***  
**Harvey & Volschenk gen. nov.**

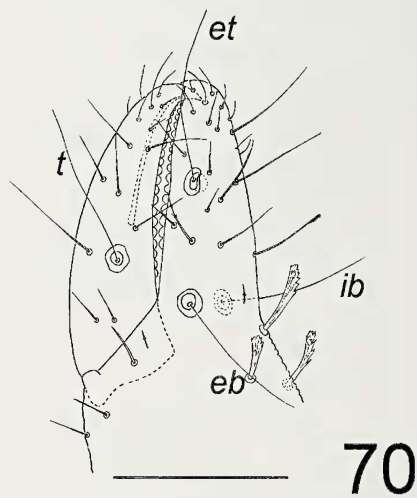
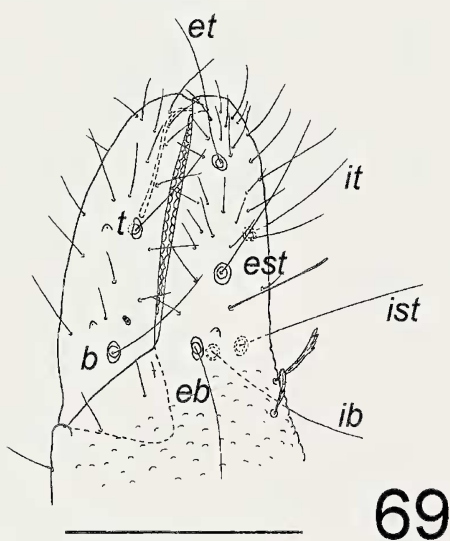
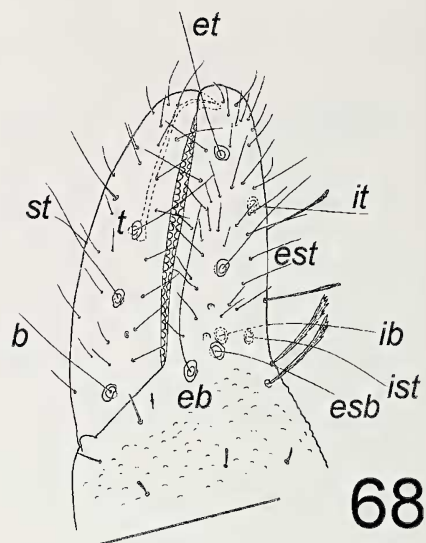
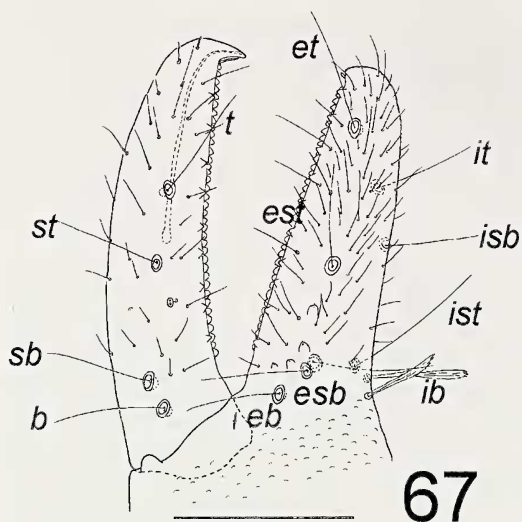
**Type species.**—*Sundochernes grayi* Beier 1975.

**Etymology.**—The generic epithet refers to

the presence of the only known species of the genus on Lord Howe Island (*satrapa*, Latin, governor of a province). The gender is masculine.

**Diagnosis.**—*Satrapanus* differs from all other chernetid genera by the following combination of characters: flagellum with 4 blades (Fig. 63); female genitalia with 2 thickened anteriorly-directed spermathecae fused basally





Figures 67–70.—*Satrapanus grayi* (Beier 1975) from Lord Howe Island, left chelal fingers, lateral: 67. Female (AM); 68. Tritonymph (AM); 69. Deutonymph (AM); 70. Protonymph (AM). Scale lines = 0.2 mm (Figs. 67–69), 0.1 mm (Fig. 70). See Methods for abbreviations.

into large bursa (Fig. 66); legs III and IV without tactile setae (Fig. 62); carapace dark colored except for pale metazone, and with two transverse furrows (Figs. 6, 60); single pair of eye-spots present (Fig. 60); vestitural setae generally short, slightly curved, dentate and clavate (Fig. 61); base of fixed chelal finger with long, clavate-dentate setae, 2 on dorsum and 2 on internal margin (Figs. 61, 67–70).

**Description.**—*Adults*: Vestitural setae mostly short, slightly curved, dentate and clavate, except for 4 setae at base of fixed chelal finger which are long and clavate-dentate se-

tae, 2 on dorsum and 2 on internal margin (Figs. 61, 67).

**Pedipalps**: with most surfaces finely to heavily granulate; fingers generally smooth. Fixed finger with 8 trichobothria, movable chelal finger with 4 trichobothria (Figs. 61, 67); *esb* closer to *eb* than to *est*; *isb* approximately midway between *it* and *ist*; *it* situated in distal third of fixed finger; *sb* closer to *b* than to *st*. Marginal teeth of chela all closely spaced; both chelal fingers with external row of accessory teeth, but without internal row of accessory teeth (Fig. 67). Venom apparatus

present in movable finger with nodus ramosus terminating slightly anterior to *st* (Fig. 67).

Chelicera (Figs. 63–65): with 6 setae on hand; *ls* and *is* long and acuminate, *sbs* and *bs'* short and dentate, *bs''* and *es* short and acuminate; movable finger with 1 acuminate seta (*gs*); with 2 dorsal and 1 ventral lyrifissures; lamina exterior present; movable finger with single dorsal tooth; galea long and slender with 4 small rami (♂) or 6 longer rami (♀); flagellum composed of 4 blades; distal blade dentate along anterior margin, remaining blades smooth.

Cephalothorax (Figs. 6, 60): carapace with 1 pair of eye-spots; yellow-brown or red-brown, with metazone pale yellow or creamy white, sometimes with a central darker patch; with two transverse furrows; posterior margin slightly angulate. Median maxillary lyrifissure present and sub-medially situated; posterior maxillary lyrifissure present.

Abdomen: tergites and sternites generally divided (Fig. 6). Pleural membrane wrinkled striate for entire length, without setae. Each stigmatic sclerite with 1 or more setae. Spiracles simple, with spiracular helix.

Genitalia: male genitalia of typical chernetid form; female genitalia with 2 thickened anteriorly-directed spermathecae fused basally into large bursa (Fig. 66).

Legs: legs I and II with an oblique junction between femur and patella; legs III and IV without tactile setae on tibiae or tarsi (Fig. 62); metatarsus and tarsus fused into single segment (tarsus); tarsi with single raised slit sensillum; subterminal tarsal seta curved and acuminate; tarsal claws simple; arolium slightly shorter than claws (Fig. 62).

*Nymphs*: Much like adults, but trichobothrial patterns as follows: tritonymph with 7 on fixed finger and 3 on movable finger (Fig. 68); deutonymph with 6 on fixed finger and 2 on movable finger (Fig. 69); and protonymph with 3 on fixed finger and 1 on movable finger (Fig. 70). Chelicera of protonymph lacking seta *gs*. Tarsi without single raised slit sensillum in protonymph.

**Remarks.**—The genus *Satrapanus* appears to be restricted to Lord Howe Island where a single species, *S. grayi*, occurs. As discussed above only a few genera of Chernetidae possess four blades in the cheliceral flagellum and also lack a tactile seta on tarsi of legs III and IV. The morphology of the female genitalia,

with two short spermathecal ducts, distinguishes *Satrapanus* from *Chelodamus*, *Chernes*, *Hesperochnes*, *Chelanops*, *Semeiochnes*, *Illinichernes*, *Gigantochernes*, *Cocinachernes*, *Paraustrochnes* (Fig. 2) and *Nesochernes* (Fig. 1). The spermathecal morphology of *Atherochnes* and *Eumecochnes* are unknown but each can be readily separated from *Satrapanus*. *Atherochnes* has only 5 setae on the cheliceral hand (6 or 7 setae in *Satrapanus*), and by the presence of accessory teeth only on the movable chelal finger (accessory teeth on both chelal fingers in *Satrapanus*) (Beier 1954a). *Eumecochnes* has trichobothrium *isb* situated basally to *est* (Beier 1932), whereas it is situated slightly distal to *est* in *Satrapanus*. *Satrapanus* differs from *Troglochnes* by the presence of eye-spots, which are lacking in *Troglochnes*, by the morphology of the female genitalia in which the spermathecae are anteriorly directed and discharging from a large bursa, and by the color of the carapace in which the metazone is paler than the remaining carapace in *Satrapanus* but is uniformly unicolored in *Troglochnes*.

*Satrapanus* differs from the other Australian species of Chernetidae which possess four flagellar blades as follows: from *Austrochnes* by the lack of tactile setae on tarsus IV [present in *Austrochnes*, see With (1905); Beier (1932)]; from *Paraustrochnes* by the position of trichobothria *isb* and *it*, which are situated distal to *est* in *Satrapanus*, but are situated adjacent to *est* in *Paraustrochnes* [see Beier (1966)], and by the morphology of the female genitalia which consists of a single pair of spermathecae in *Satrapanus* (Fig. 66), and two pairs of spermathecae in *Paraustrochnes* (Fig. 2); and from *Marachernes* by the general shape of the chela (which is not much wider than the base of the fingers in *Marachernes*) and the lack of an internobasal mound bearing accessory teeth on the male movable chelal finger (Harvey 1992a, 1994).

***Satrapanus grayi* (Beier 1975)**

new combination

Figs. 6, 60–71

**Type material.**—AUSTRALIA: *New South Wales*: Holotype male, near Old Settlement, Lord Howe Island [31°30'S, 159°03'E], 67 m, 30 January 1971, M. Gray (AM KS20).

**Other material examined.**—AUSTRALIA:



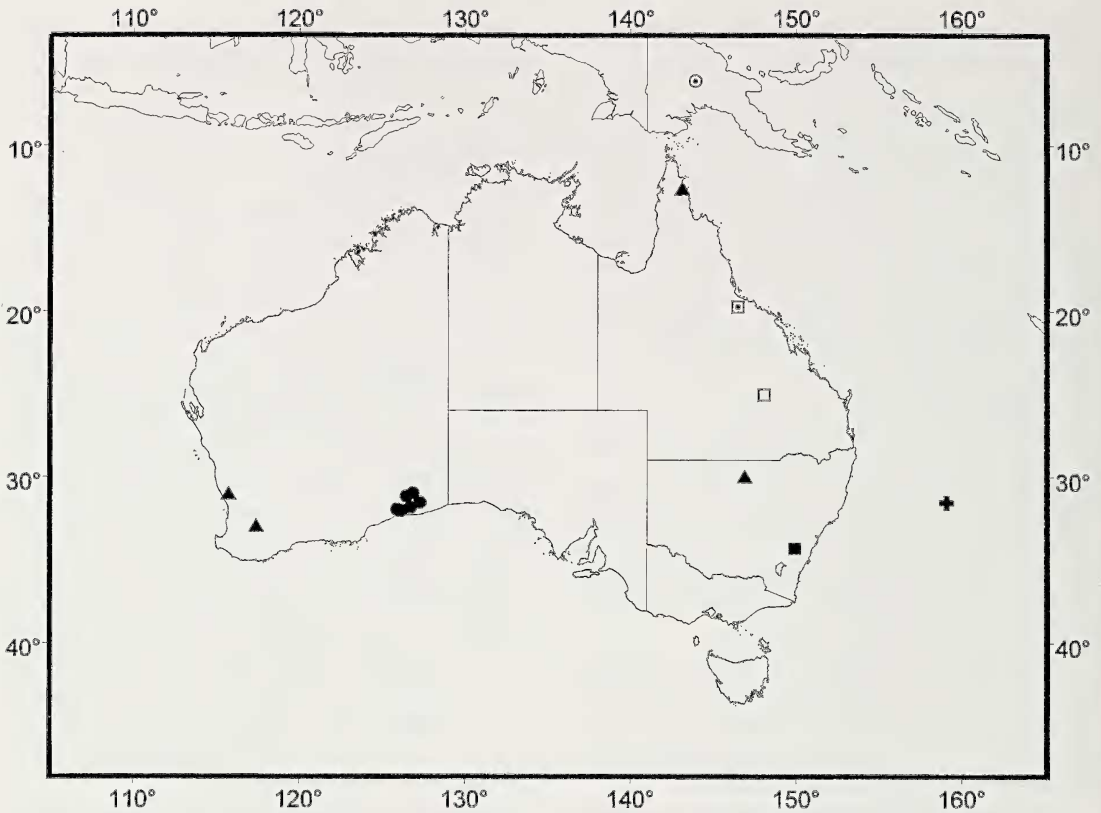


Figure 71.—Map showing recorded distributions of species of *Trogloderes* and *Satrapanus*: *T. cruciatus* new species (□), *T. dewae* (Beier) (▲), *T. guanophilus* (Beier) (■), *T. imitans* Beier (●), *T. novae-guineae* (Beier) (○), *T. omorgus* new species (□), and *Satrapanus grayi* (Beier) (+).

LIA: *New South Wales*: Lord Howe Island: 1 ♀, N. end of Big Pocket at base of Razorback, Mt. Gower, IH030A, 31°35'15"S, 159°04'08"E, 26 April 2002, leaf litter, I. Hutton (AM KS96521); 1 ♂, S end of Big Pocket at base of Razorback, Mt. Gower, IH030B, 31°36'00"S, 159°04'11"E, 26 April 2002, leaf litter, I. Hutton (AM KS96527); 1 ♂, 4 ♀, 1 tritonymph, 2 deutonymphs, 16 protonymphs, eastern end of Boat Harbour beach, LHIS032L, 31°33'37"S, 159°05'53"E, 3 December 2000, leaf litter, CBCR (WAM T75452); 1 ♂, above trail to Boat Harbour, opp. turnoff to Mutton Bird Point, LHIS021/04, 31°32'57"S, 159°05'24"E, 26 November–3 December 2000, pit trap, CBCR (AM KS96566); 2 ♀, 7 protonymphs, approx. 25 m above above coastal trail to Boat Harbour, 750 m from start, LHIS030L, 31°32'51"S, 159°05'10"E, 3 December 2000, leaf litter, CBCR (AM KS96562); 1 deutonymph, on trail to The Clear Place, LHI/JT/05L, 31°31'

51"S, 159°04'35"E, 21 February 2001, leaf litter, J. Tarnawski (AM KS96564); 1 ♂, 1 protonymph, eastern slope of Dawsons Point Ridge above old Settlement, LHIS014L, 31°31'15"S, 159°03'07"E, 1 December 2000, leaf litter, CBCR (AM KS96553); 1 ♂, western slope of Dawson's Point Ridge off North Beach Trail, LHIS012aL, 31°31'12"S, 159°02'27"E, 20 November 2000, leaf litter, CBCR (AM KS96555); 1 ♀, point where walking trial first enters Erskine Valley from coast, LHIS043L, 31°34'33"S, 159°04'17"E, 2 December 2000, leaf litter, CBCR (AM KS96524); 1 ♂, 3 tritonymphs, on walking track to Erskine Valley, adjacent to Salmon Beach, LHIS/GC/L18, 31°33'39"S, 159°04'31"E, 10 December 2000, leaf litter, G. Cassis (AM KS 96548); 1 deutonymph, walking trial through Erskine Valley, LHIS042L, 31°34'34"S, 159°04'31"E, 2 December 2000, leaf litter, CBCR (AM KS96517); 1 tritonymph, walking trial through Erskine Valley,

LHIS045L, 31°34'37"S, 159°04'33"E, 2 December 2000, leaf litter, CBCR (AM KS96528); 2 tritonymphs, "Get Up Place," trail to Mount Gower, LHIS048L, 31°34'58"S, 159°04'52"E, 2 December 2000, leaf litter, CBCR (AM KS96547); 2 tritonymphs, Goat House walking track, Intermediate Hill, LHI/JT/09L, 31°33'15"S, 159°04'57"E, 23 February 2001, leaf litter, J. Tamawski, M. Shea (AM KS 96529); 1 ♂, 1 protonymph, Goat House walking track, Intermediate Hill, LHI/JT/09L, 31°33'15"S, 159°04'56"E, 23 February 2001, leaf litter, J. Tamawski, M. Shea (AM KS96509); 3 tritonymphs, Goat House walking track, Intermediate Hill, LHI/JT/09L, 31°33'15"S, 159°04'56"E, 23 February 2001, leaf litter, J. Tamawski, M. Shea (AM KS96525); 1 ♀, 1 tritonymph, Goat House walking track, Intermediate Hill, LHI/GC/L07, 31°33'17"S, 159°05'05"E, 6 December 2000, leaf litter, G. Cassis (AM KS96506); 2 ♂, 1 ♀, 1 protonymph, ridge below Intermediate Hill, Boat Harbour walking trail, LHI/GC/L35, 31°32'59"S, 159°05'24"E, 12 December 2000, leaf litter, G. Cassis (AM KS96568); 1 ♂, 1 ♀, 1 tritonymph, Lagoon beach between rubbish tip and airstrip, LHIS022/04, 31°32'31"S, 159°04'31"E, 27 November–4 December 2000, pit trap, CBCR (AM KS96543); 1 deutonymph, 1 protonymph, Little Island, coastal track to Erskine Valley, LHIS/GC/L37, 31°34'10"S, 159°04'26"E, 13 December 2000, leaf litter, G. Cassis (AM KS96552); 1 ♂, 1 ♀, Little Island, coastal track to Erskine Valley, LHIS/GC/L38, 31°34'10"S, 159°04'26"E, 13 December 2000, leaf litter, G. Cassis (AM KS96516); 4 ♂, 4 ♀, Little Island, below Far Flats, IH021B, 31°34'08"S, 159°04'32"E, 10 August 2001, leaf litter, I. Hutton (WAM T75453); 2 ♂, 1 ♀, 2 tritonymphs, "Little Slope," LHIS051L, 31°35'12"S, 159°04'03"E, 30 November 2000, leaf litter, CBCR (AM KS96512); 2 ♂, 2 ♀, 2 tritonymphs, southern end of Little Slope, IH018A, 31°35'15"S, 159°04'04"E, 28 June 2001, leaf litter, I. Hutton (AM KS96515); 2 ♂, 1 tritonymph, Malabar Hill, on path to Kim's Lookout, LHIS004L, 31°30'54"S, 159°03'22"E, 24 November 2000, leaf litter, CBCR (AM KS96554); 6 ♀, 3 tritonymphs, 3 deutonymphs, 3 protonymphs, north-western slope of Malabar Hill, IH019A, 31°31'08"S, 159°03'42"E, 7 August 2001, leaf litter, I. Hutton (AM KS96558); 1 deutonymph, 20 m SE

of walking track on Malabar Hill, half way to summit, IH022B, 31°31'00"S, 159°03'41"E, 10 August 2001, leaf litter, I. Hutton (AM KS96557); 1 ♂, 1 ♀, 2 tritonymphs, walking track on Malabar Hill, 50 m north of summit, IH022A, 31°30'50"S, 159°03'39"E, 10 August 2001, leaf litter, I. Hutton (AM KS96530); 1 ♀, 10 m NW Malabar Hill walking track in forest at beginning, IH022C, 31°31'10"S, 159°03'44"E, 10 August 2001, leaf litter, I. Hutton (AM KS96550); 1 ♀, western slope of Malabar Ridge, S. of Kim's lookout, LHIS007L, 31°30'57"S, 159°03'31"E, 24 November 2000, leaf litter, CBCR (AM KS96545); 1 protonymph, eastern slope of Malabar Ridge above Neds Beach, LHIS0011L, 31°31'03"S, 159°03'38"E, 19 November 2000, leaf litter, CBCR (AM KS96551); 1 tritonymph, approx. 50 m S of summit of Mt. Eliza on western face, LHIS005L, 31°30'57"S, 159°02'25"E, 20 November 2000, leaf litter, CBCR (AM KS96526); 1 ♀, 1 protonymph, approx. 50 m S of summit of Mt. Eliza on western face, LHIS005/05, 31°30'57"S, 159°02'25"E, 25 November–2 December 2000, pit trap, CBCR (AM KS96544); 2 deutonymphs, Mt. Gower, middle summit, IH024B, 31°35'15"S, 159°04'29"E, 28 August 2001, leaf litter, I. Hutton (AM KS96534); 1 ♀, N-face of Mt. Gower, IH013D, 31°34'58"S, 159°04'28"E, 26 May 2001, leaf litter, I. Hutton (AMKS96565); 1 tritonymph, eastern face of Mt. Lidgberg, LHIS039L, 31°34'27"S, 159°05'04"E, 3 December 2000, leaf litter, CBCR (AM KS96531); 1 tritonymph, 1 deutonymph, 2 protonymphs, Muttonbird point booby colony area, IH015B, 31°33'00"S, 159°05'24"E, 22 June 2001, leaf litter, I. Hutton (AM KS96542); 1 ♂, North Hummock (trail to Intermediate Hill), LHIS020/01, 31°32'54"S, 159°04'58"E, February 2001, pit trap (AM KS96504); 1 protonymph, just behind beach at "Old Gulch" on western footslopes, LHIS006/01, 31°30'53"S, 159°02'36"E, 2–11 December 2000, pit trap, CBCR (AM KS96533); 1 protonymph, just behind beach at "Old Gulch" on western footslopes, LHIS006/05, 31°30'53"S, 159°02'36"E, 25 November–2 December 2000, pit trap, CBCR (AM KS96549); 1 deutonymph, Peach Tree Ridge, just below summit of Intermediate Hill, LHIS023L, 31°33'01"S, 159°05'05"E, 3 December 2000, leaf litter (AM KS96563); 1 ♂, 1 protonymph, eastern slope of Philip Point



(North Head), LHS015L, 31°31'20"S, 159°02'29"E, 1 December 2000, leaf litter, CBCR (AM KS96519); 3 ♂, 2 ♀, 1 protonymph, eastern slope of Philip Point (North Head), LHS015L, 31°31'20"S, 159°02'29"E, 1 December 2000, leaf litter, CBCR (AM KS96540); 4 ♂, 3 ♀, 7 deutonymphs, 1 protonymph, in forest behind Research Station, LHI/JT/08L, 31°31'37"S, 159°03'58"E, 22 February 2001, leaf litter, J. Tamawski (AM KS96514); 1 ♂, 1 ♀, Rocky Run Creek, where Intermediate Hill track crosses, IH031A, 31°33'22"S, 159°05'14"E, 18 May 2002, leaf litter, I. Hutton (AM KS96507); 1 tritonymph, 1 deutonymph, Rocky Run, east side of creek, IH023B, 31°31'10"S, 159°05'34"E, 25 August 2001, leaf litter, I. Hutton (AM KS96513); 1 ♀, Rocky Run, east side of creek, IH023B, 31°31'10"S, 159°05'34"E, 25 August 2001, leaf litter, I. Hutton (AM KS96518); 1 deutonymph, Rocky Run Creek, where Intermediate Hill track crosses, IH031C, 31°33'22"S, 159°05'14"E, 18 May 2002, leaf litter, I. Hutton (AM KS96539); 1 ♂, Rocky Run Creek, where Intermediate Hill track crosses, IH031D, 31°33'22"S, 159°05'14"E, 18 May 2002, leaf litter, I. Hutton (AM KS96508); 1 tritonymph, N. bank of Rocky Run Creek, at junction with coastal trail to Boat Harbour, LHS024L, 31°33'19"S, 159°05'33"E, 21 November 2000, leaf litter, CBCR (AM KS96511); 1 protonymph, base of 'Round Face', Mt. Lidgberg, Far Flats, LHS036L, 31°34'09"S, 159°04'35"E, 27 November 2000, pit trap, CBCR (AM KS96532); 1 tritonymph, base of "Round Face," Mt. Lidgberg, Far Flats, LHS036/04, 31°34'09"S, 159°04'35"E, 4–14 December 2000, pit trap, CBCR (AM KS96559); 1 ♀, base of "Round Face," Mt. Lidgberg, Far Flats, site LHS036/04, 31°34'09"S, 159°04'35"E, 27 November–4 December 2000, pit trap, CBCR (AM KS96505); 1 tritonymph, base of "Round Face," Mt. Lidgberg, Far Flats, LHS036/02, 31°34'09"S, 159°04'35"E, February 2001, pit trap, CBCR (AM KS96567); 1 ♂, Stephens Reserve, New Settlement, IH025B, 31°31'33"S, 159°03'53"E, 30 September 2001, leaf litter, I. Hutton (AM KS96510); 1 ♂, 1 tritonymph, Stephens Reserve, New Settlement, IH025D, 31°31'33"S, 159°03'53"E, 30 September 2001, leaf litter, I. Hutton (AM KS96535); 1 protonymph, Stephens Reserve, New Settlement, LHS059/01, 31°31'33"S,

159°03'53"E, 4–14 December 2000, pit trap, CBCR (AM KS96560); 1 ♂, Stephens Reserve, New Settlement, LHS059/05, 31°31'33"S, 159°03'53"E, 4–14 December 2000, pit trap, CBCR (AM KS96520); 1 tritonymph, Stephens Reserve, New Settlement, LHS058/02, 31°31'33"S, 159°03'53"E, 4–14 December 2000, pit trap, CBCR (AM KS96561); 2 ♂, Stephens Reserve, New Settlement, IH025A, 31°31'33"S, 159°03'53"E, 30 September 2001, leaf litter, I. Hutton (AM KS96536); 1 ♂, Stephens Reserve, New Settlement, LHS059/02, 31°31'33"S, 159°03'53"E, 4–14 December 2000, pit trap, CBCR (AM KS96569); 1 ♂, 1 ♀, The Saddle, Erskine Valley, LHS046L, 31°34'49"S, 159°04'58"E, 2 December 2000, leaf litter, CBCR (AM KS96537); 1 ♀, 2 protonymphs, eastern aspect of Transit Hill near summit, LHS018L, 31°32'01"S, 159°04'43"E, 19 November 2000, leaf litter, CBCR (AM KS96541); 2 tritonymphs, 1 protonymph, south-eastern aspect of Transit Hill near summit, LHS019/01, 31°32'13"S, 159°04'40"E, 1–11 December 2000, pit trap, CBCR (AM KS965122); 2 ♂, 1 protonymph, creek gully crossing Transit Hill walking track, IH020B, 31°31'51"S, 159°04'22"E, 9 August 2001, leaf litter, I. Hutton (AM KS96523); 1 ♀, 1 deutonymph, south-eastern aspect of Transit Hill near summit, LHS019L, 31°32'13"S, 159°04'40"E, 24 November 2000, leaf litter, CBCR (AM KS96546); 1 protonymph, site 58, 31°31'33"S, 159°03'53"E, 12 December 2000, litter, *Ficus* (AM KS96538); 3 protonymphs, site 59, 31°31'33"S, 159°03'53"E, 13 December 2000, litter (AM KS96556).

**Diagnosis.**—As for genus.

**Description.**—*Adults*: Pedipalps, carapace, coxae and tergites deep reddish-brown; sternites and legs light red-brown in color. Vestitural setae short, slightly curved, and dentate; most sternal setae acicular with few dentate. Pleural membrane wrinkled plicate for entire length.

Pedipalps (Fig. 61): robust, with trochanter 1.31–1.81 (♂), 1.58–1.83 (♀), femur 2.95–3.84 (♂), 2.56–3.40 (♀), patella 2.18–2.69 (♂), 2.35–2.77 (♀), chela (with pedicel) 2.71–3.20 (♂), 2.55–3.08 (♀), chela (without pedicel) 2.53–3.05 (♂), 2.42–2.97 (♀), hand strongly rounded, 1.26–1.71 (♂), 1.29–1.74 (♀) times longer than wide; movable finger 0.41–0.48 (♂), 0.42–0.46 (♀) times the length of the chela (with pedicel). All surfaces of

pedipalp finely to heavily granulate with exception of chelal fingers, and entire movable finger. Fixed finger with 36 ( $\delta$ ,  $\varphi$ ) marginal teeth, plus 8 ( $\delta$ ), 10 ( $\varphi$ ) external accessory teeth and 1 ( $\delta$ ,  $\varphi$ ) internal accessory tooth; movable finger with 39 ( $\delta$ ,  $\varphi$ ) marginal teeth, plus 7 ( $\delta$ ), 9 ( $\varphi$ ) external accessory teeth and without internal accessory teeth. Pedipalpal setae short, stout and clavate-dentate, except on fingers where they are acuminate, and at base of fixed finger where 2 very long, stout, dentate setae are present on dorsum and 2 similar setae on internal margin (Fig. 61). Fixed finger with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 67); *esb* closer to *eb* than to *est*; *est* slightly closer to *esb* than to *et*, which is situated sub-distally; *isb* inserted dorsally, rather than internally or externally, and closer to *it* than to *ist*; *ist* adjacent to *ib*; *sb* closer to *b* than to *st*; *st* slightly closer to *t* than to *sb*, which is situated in distal third of movable finger. Venom apparatus present in movable finger with nodus ramosus terminating midway between *t* and *st* (Fig. 67); fixed finger with vestigial venom apparatus. External margin of fixed chelal finger with 3–4 “sense spots,” internal margin of fixed chelal finger with 8 ( $\delta$ ), 5 ( $\varphi$ ) “sense spots,” and external margin of movable chelal finger 2–3 “sense spots”; diploid sensillum situated between *sb* and *st*.

Chelicera (Fig. 64): with 6–7 setae on hand; *ls* and *is* long and acuminate, *sbs* and *bs'* short and dentate, *bs''* and *es* short and acuminate; movable finger with 1 acuminate seta (*gs*); with 2 dorsal and 1 ventral lyrifissures; lamina exterior present; movable finger with single dorsal tooth; galea long and slender with 4 small rami ( $\delta$ ) (Fig. 64) or 6 longer rami ( $\varphi$ ) (Fig. 65); flagellum composed of 4 blades (Fig. 63); distal blade dentate along anterior margin, remaining blades smooth; third and fourth blades very closely adpressed. Serrula exterior with 16–17 lamellae.

Cephalothorax: carapace (Figs. 6, 60): 1.03–1.14 ( $\delta$ ), 0.85–1.15 ( $\varphi$ ) times as long as broad; yellow-brown or red-brown, with metazone pale yellow or creamy white, sometimes with a central darker patch; with 1 pair of pale eye-spots; with 4–5 setae on anterior margin, with 8–10 setae on posterior margin; posterior half with two moderately incised transverse furrows, anterior furrow crosses the carapace at ca. 0.58 of its length, posterior fur-

row crosses at ca. 0.83 of carapace length; posterior margin slightly angulate; lightly granulate with exception of median area and transverse furrows. Manducatory process with 1 long distal and 1 shorter sub-distal seta, with sub-oral seta; remainder of maxilla with 26 ( $\delta$ ), 38 ( $\varphi$ ) setae. Chaetotaxy of coxae I–IV:  $\delta$ , 18: 25: 27: 31;  $\varphi$ , 19: 21: 27: ca. 42.

Abdomen: tergites I–X (Fig. 6) and sternites IV–X ( $\delta$ ,  $\varphi$ ) divided. Tergal chaetotaxy:  $\delta$ , 10: 10: 9: 11: 12: 12: 11: 11: 10: 8: 4: 2;  $\varphi$ , 8: 10: 12: 12: 12: 12: 13: 12: 10: 9: 4: 2; setae restricted to posterior and lateral tergal margins. Sternal chaetotaxy:  $\delta$ , 26: (2) 18 [3+3] (2): (2) 12 (2): 16: 18: 17: 14: 14: 10: 4: 2;  $\varphi$ , 19: (2) 16 (2): (2) 11 (2): 14: 18: 20: 17: 15: 11: 5: 2.

Genitalia: male genital opercula with setae generally long and curved; anterior operculum with 1 pair of slit sensilla and posterior operculum with 2 pairs. Female genital opercula with curved setae arranged approximately in inverted U; anterior and posterior opercula each with 1 pair of small slit sensilla. Male genitalia of typical chernetid form (Vachon 1938). Female genitalia with 2 thickened anteriorly-directed spermathecae fused basally into large bursa near genital operculum (Fig. 66); spermathecae covered with small structures that appear to be pores.

Legs: legs I and II with an oblique junction between femur and patella. Leg IV (Fig. 62) with femur + patella 3.41 ( $\delta$ ), 3.73 ( $\varphi$ ) times longer than broad. Tibiae and tarsi of legs III and IV without tactile setae. Tarsi with single raised slit sensillum. Tarsal claws simple; arolium slightly shorter than claws.

**Dimensions (mm).**—*Male from Lord Howe Island (AM), with 9 other specimens (AM) in parentheses, where appropriate:* Body length 1.86 (1.68–2.03). Pedipalps: trochanter 0.357/0.210 (0.296–0.366/0.187–0.262), femur 0.626/0.212 (0.582–0.810/0.189–0.261), patella 0.557/0.245 (0.499–0.698/0.229–0.310), chela (with pedicel) 0.969/0.337 (0.876–1.186/0.322–0.385), chela (without pedicel) 0.915 (0.832–1.106), hand length 0.490 (0.426–0.593), movable finger length 0.456 (0.419–0.520). Chelicera 0.255/0.28, movable finger length 0.192. Carapace 0.735/0.717 (0.598–0.703/0.568–0.624). Leg I: femur 0.192/0.141, patella 0.275/0.114, tibia 0.285/0.084, tarsus 0.338/0.069. Leg IV: fe-



mur + patella 0.545/0.160, tibia 0.420/0.101, tarsus 0.361/0.077.

*Female from Lord Howe Island (AM), with 9 other specimens (AM) in parentheses, where appropriate:* Body length 2.17 (1.91–2.78). Pedipalps: trochanter 0.397/0.217 (0.338–0.426/0.206–0.248), femur 0.675/0.224 (0.603–1.009/0.206–0.297), patella 0.610/0.256 (0.567–0.905/0.214–0.331), chela (with pedicel) 1.101/0.398 (0.988–1.310/0.366–0.456), chela (without pedicel) 1.040 (0.938–1.260), hand length 0.557 (0.501–0.754), movable finger length 0.486 (0.418–0.591). Chelicera 0.273/0.144, movable finger length 0.196. Carapace 0.787/0.928 (0.743–0.851/0.647–0.848). Leg I: femur 0.224/0.156, patella 0.319/0.119, tibia 0.307/0.085, tarsus 0.326/0.065. Leg IV: femur + patella 0.615/0.165, tibia 0.462/0.101, tarsus 0.381/0.077.

*Tritonymphs:* Morphology generally as in adults. Pedipalps, carapace, coxae and legs pale red-brown, remainder of body pale red-yellow.

Chelicera: with 6 setae on hand, *ls* and *is* long and acuminate, *sbs* and *bs'* short and dentate, *bs''* and *es* short and acuminate; movable finger with 1 sub-distal seta (*gs*). Movable finger with single dorsal tooth. Galea long and slender with 4 small distal and 1 small sub-distal rami. Flagellum composed of 4 blades.

Pedipalp: trochanter 2.84, femur 2.82, patella 2.22, chela (with pedicel) 2.74, chela (without pedicel) 2.58 times longer than wide. Fixed chelal finger with 7 trichobothria, movable chelal finger with 3 trichobothria (Fig. 68): *isb* and *sb* absent; *esb* situated near *eb*; *est* slightly closer to *esb* than to *et*; *ist* adjacent to *ib*; *st* midway between *sb* and *t*, the latter situated in distal third of movable finger. Two very long, stout, dentate setae present on dorsum of chelal hand at base of fixed finger (Fig. 68). Chelal teeth: fixed finger with 28 marginal teeth, plus 4 external accessory teeth and 1 internal accessory tooth; movable finger with 35 marginal teeth, plus 5 external accessory teeth and no internal accessory teeth. Venom apparatus present in movable finger with nodus ramosus terminating adjacent to *t* (Fig. 68). External margin of fixed chelal finger with 2 "sense spots," internal margin of fixed chelal finger with 1 "sense spot," and movable chelal finger without "sense spots."

Cephalothorax: carapace 1.01 times longer

than broad; with 1 pair of very faint eye-spots; with 4 setae on anterior margin and 8 setae on posterior margin; with two deep furrows.

Abdomen: Pleural membrane uniformly wrinkled plicate. Tergites I–X and sternites II–X with medial suture line. Tergal chaetotaxy: 6: 9: 8: 8: 9: 10: 10: 10: 8: 4: 2. Sternal chaetotaxy: 7: (1) 9 (1): (2) 8 (2): 14: 15: 13: 13: 11: 10: 4: 2.

Legs: legs I and II with an oblique junction between femur and patella. Tibiae and tarsi of legs III and IV without tactile setae. Tarsi with single raised slit sensillum. Tarsal claws simple; arolium slightly shorter than claws.

**Dimensions (mm).**—*Tritonymph from Lord Howe Island (AM):* Body length 1.82. Pedipalps: trochanter 0.317/0.178, femur 0.505/0.179, patella 0.457/0.206, chela (with pedicel) 0.846/0.308, chela (without pedicel) 0.796, movable finger length 0.352, hand length 0.443. Carapace 0.627/0.621.

*Deutonymphs:* Morphology generally as in adults. Pedipalps and carapace pale red-brown, abdomen pale yellow.

Chelicera: with 5 setae on hand, *ls*, *is*, *bs* and *es* acuminate, *sbs* dentate; movable finger with 1 sub-distal seta (*gs*). Movable finger with single dorsal tooth. Galea long and slender with 4 small distal to sub-distal rami. Flagellum composed of 4 blades.

Pedipalp: trochanter 1.78, femur 2.67, patella 1.91, chela (with pedicel) 2.59, chela (without pedicel) 2.47 times longer than wide. Fixed chelal finger with 6 trichobothria, movable chelal finger with 2 trichobothria (Fig. 69): *esb*, *isb*, *sb* and *st* absent; *est* closer to *eb* than to *et*; *ist* adjacent to *ib*. Two very long, stout, dentate setae present on dorsum of chelal hand at base of fixed finger (Fig. 69). Chelal teeth: fixed finger with 21 marginal teeth, plus 1 internal accessory tooth; movable finger with 23 marginal teeth, with no accessory teeth. Venom apparatus present in movable finger with nodus ramosus terminating near *t* (Fig. 69). External margin of fixed chelal finger with 1 "sense spot," internal margin of fixed chelal finger with 2 "sense spots," and external margin of movable chelal finger with 2 "sense spots."

Cephalothorax: carapace 1.17 times longer than broad; with 1 pair of eye-spots; with 4 setae on anterior margin and 8 setae on posterior margin; with two shallow furrows.

Abdomen: Pleural membrane uniformly

wrinkled plicate. Tergites I–X and sternites II–X with medial suture line. Tergal chaetotaxy: 8: 8: 8: 8: 8: 8: 8: 8: 8: 6: 6: 2. Sternal chaetotaxy: 0: (1) 4 (1): (2) 6 (2): 10: 10: 10: 10: 10: 8: 6: 2.

Legs: legs I and II with an oblique junction between femur and patella. Tibiae and tarsi of legs III and IV without tactile setae. Tarsi with single raised slit sensillum. Tarsal claws simple; arolium slightly shorter than claws.

**Dimensions (mm).**—*Deutonymph* from Lord Howe Island (AM): Body length 1.48. Pedipalps: trochanter 0.257/0.146, femur 0.384/0.144, patella 0.352/0.184, chela (with pedicel) 0.675/0.261, chela (without pedicel) 0.646, movable finger length 0.319, hand length 0.384. Carapace 0.530/0.454.

*Protonymphs*: Morphology generally as in adults. Pedipalps and carapace pale yellow, abdomen white.

Chelicera: with 4 setae on hand, *ls*, *is*, *bs* and *es*, all acuminate; movable finger without seta. Movable finger with single dorsal tooth. Galea long and slender with 2 small distal and 1 small sub-distal rami. Flagellum composed of 4 blades.

Pedipalp: trochanter 2.66, femur 2.39, patella 1.81, chela (with pedicel) 2.81, chela (without pedicel) 2.65 times longer than wide. Fixed chelal finger with 3 trichobothria, movable chelal finger with 1 trichobothrium (Fig. 70): *esb*, *est*, *isb*, *ist*, *it*, *b*, *sb* and *st* absent; *et* situated sub-distally, *eb* and *ib* situated basally, and *t* situated medially. Three very long, stout, dentate setae present on dorsum of chelal hand at base of fixed finger (Fig. 70). Chelal teeth: fixed finger with 21 marginal teeth; movable finger with 21 marginal teeth; both fingers without accessory teeth. Venom apparatus present in movable finger with nodus ramosus terminating distal to *t* (Fig. 70). Chelal fingers without "sense spots."

Cephalothorax: carapace 1.66 times longer than broad; eye-spots not visible; with 4 setae on anterior margin and 6 setae on posterior margin; with two very shallow furrows.

Abdomen: Pleural membrane uniformly wrinkled plicate. Tergites II–X and sternites V–X with medial suture line. Tergal chaetotaxy: 6: 6: 6: 7: 6: 6: 6: 6: 6: 6: 4: 2. Sternal chaetotaxy: 0: (0) 2 (0): (1) 4 (1): 6: 6: 6: 6: 6: 6: 4: 2.

Legs: legs I and II with an oblique junction between femur and patella. Tibiae and tarsi of

legs III and IV without tactile setae. Tarsi without single raised slit sensillum. Tarsal claws simple; arolium slightly shorter than claws.

**Dimensions (mm).**—*Protonymphs* from Lord Howe Island (AM): Body length 1.08. Pedipalps: trochanter 0.165/0.062, femur 0.227/0.095, patella 0.203/0.112, chela (with pedicel) 0.413/0.147, chela (without pedicel) 0.390, movable finger length 0.198, hand length 0.189. Carapace 0.416/0.250.

**Remarks.**—*Satrapanus grayi* has been found at a variety of locations on Lord Howe Island (Fig. 71) where it occurs in leaf litter and other ground habitats.

## DISCUSSION

The Chernetidae are the largest pseudoscorpion family with 112 genera and more than 650 valid species. Harvey (1991) recorded 110 genera, and while six new genera have since been named (Harvey 1992a, 1995; Mahnert 1994, 2001; Muchmore 1997; Dashdamirov 2005), four genera have been synonymized (Muchmore 1992, 1996, 1999; Mahnert 1994). The Australasian fauna is poorly known with only 37 named genera (Table 1) and with many unnamed species represented in museum collections. Including the two new species named in this manuscript, there are only 36 indigenous species named from Australia, 36 from New Zealand, 4 from New Caledonia, 21 from Papua New Guinea, and 20 species from Indonesia. The present study has partially clarified the identity of the genus *Sundochernes* by removing some species originally included in that genus. Three of these species were transferred to *Troglochernes*, a genus originally named for a peculiar troglobite, *T. imitans*, found within caves situated in the Nullarbor karst of southern Australia. A third was removed to a new genus, *Satrapanus*, thus far only known from Lord Howe Island, and two new species were named, one from a cave in north-eastern Queensland and the other from a beetle in south-eastern Queensland.

The new definition of *Troglochernes* presented here avoids the problem of characterizing a genus principally by a suite of troglomorphic features. Nevertheless, *T. imitans* remains one of the most highly modified troglobitic members of the Chernetidae, with extremely attenuated pedipalps and legs (Fig. 3),



Table 1.—Genera of indigenous Chernetidae recorded from the Australasian region.

Genus	Author	Australia	New Zealand	New Caledonia
<i>Acanthicochernes</i>	Beier 1964a			
<i>Allochernes</i>	Beier 1932			
<i>Americhernes</i>	Muchmore 1976	×		
<i>Apatochernes</i>	Beier 1948	× (Norfolk Island)	×	
<i>Austrochernes</i>	Beier 1932	×		
<i>Barbaraella</i>	Harvey 1995	×		
<i>Cacoxylus</i>	Beier 1965			
<i>Calymmachernes</i>	Beier 1954b	×		
<i>Chiridiochernes</i>	Muchmore 1972			
<i>Conicochernes</i>	Beier 1932	×		
<i>Cordylochernes</i>	Beier 1932	×		
<i>Cyclochernes</i>	Beier 1970			
<i>Gelachernes</i>	Beier 1940			
<i>Haplochernes</i>	Beier 1932	×		
<i>Hebridochernes</i>	Beier 1940			×
<i>Heterochernes</i>	Beier 1932		×	
<i>Maorichernes</i>	Beier 1932		×	
<i>Marachernes</i>	Harvey 1992a	×		
<i>Megachernes</i>	Beier 1932	×		
<i>Nesidiochernes</i>	Beier 1957	×	×	×
<i>Nesiotochernes</i>	Beier 1976		×	
<i>Nesochernes</i>	Beier 1932	× (Norfolk Island)	×	
<i>Ochrochernes</i>	Beier 1932			
<i>Opsochernes</i>	Beier 1966		×	
<i>Paracanthicochernes</i>	Beier 1966			
<i>Parachernes</i>	Beier 1932	×		
<i>Paraustrochernes</i>	Beier 1966	×		
<i>Phaulochernes</i>	Beier 1976		×	
<i>Reischekia</i>	Beier 1948		×	
<i>Satrapanus</i>	Harvey & Volschenk, this paper	× (Lord Howe Island)		
<i>Smeringochernes</i>	Beier 1957		×	
<i>Sundochernes</i>	Beier 1932	×		
<i>Sundowithius</i>	Beier 1932			
<i>Systellochernes</i>	Beier 1964b		×	
<i>Thalassochernes</i>	Beier 1932		×	
<i>Troglochernes</i>	Beier 1969	×		
<i>Verrucachernes</i>	Chamberlin 1947			
TOTAL		17	12	2

and is perhaps only rivalled by some species of the Brazilian genus *Spelaeochernes* Mahnert 2001 (Mahnert 2001). The two other cave-dwelling species of *Troglochernes*, *T. guanophilus* and *T. cruciatus* (Fig. 5), show no clear troglomorphies but are paler in coloration than the other three species, *T. novae-guineae*, *T. dewae* (Fig. 4) and *T. omorgus*, suggesting modifications resulting from their cave-dwelling existence. The absence of more obvious morphological changes in *T. guanophilus* and *T. cruciatus* may suggest a more

recent colonization of cave environments than *T. imitans*.

The Nullarbor karst is composed of Upper Eocene and Miocene limestones within the Eucla Basin that were deposited during periods when the sea level was up to 300 m above the current sea level (Lowry & Jennings 1974). Substantial uplifting during the late Miocene (10–11 mya) lifted the Eucla Basin above sea level (Lowry & Jennings 1974), thus exposing the karst to weathering and erosion. The entire plain is very flat with little

Table 1.—Extended.

Fiji	Vanuatu	Solomon Islands	Papua New Guinea	Indonesia	Extralimal
		×	×		—
				×	Palaearctic
					Pacific Islands, Americas
					—
					—
		×	×		—
				×	—
					—
					Central and South America, South Africa (doubtful)
		×			—
		×	×		—
×	×	×	×	×	Pacific Islands, Indian Ocean islands, Asia
	×	×	×	×	—
					—
					—
			×	×	Asia
			×	×	Pacific Islands
					—
				×	—
					—
		×			—
		×	×		Circum-tropical
			×		—
				×	—
		×	×	×	Pacific Islands
				×	South-east Asia, South America
			×	×	South-east Asia
					—
					—
			×		—
		×	×	×	Pacific Islands, Asia, Africa
1	2	10	13	12	

inclination. While a marine transgression covered the Roe Plain, which is situated on the southern flank of the Eucla Basin, during the Pleistocene, the remainder of the basin was unaffected. Much of the Nullarbor karst has cavernous spaces ranging from small solution pipes to enormous caves (Richards 1971; Lowry & Jennings 1974). Aspects of the biological attributes of the caves known at the time were documented by Richards (1971), who noted a number of unusual and highly modified troglobites. As well as *T. imitans*,

the arachnid fauna of the caves currently consists of several blind spiders including the mygalomorph *Troglodiplura lowryi* Main 1969, the ctenid *Janusia muiri* Gray 1973 and four species of the stiphidiid genus *Tartarus* Gray 1973, *T. mullamullangensis* Gray 1973, *T. murchisonensis* Gray 1992, *T. nurina* Gray 1992 and *T. thampannensis* Gray 1992 (Main 1969, 1993; Gray 1973, 1992), as well as a blind gnaphosid (V. Ovtsharenko, pers. comm.). Recently, the discovery and description of a large blind cryptopid centipede, *Cry-*



*tops roeplainsensis* Edgecombe 2005, with a body length of 4.6–7.8 cm, from two caves on the Roe Plains (Edgecombe 2005) highlights that further troglobites are to be expected from the region.

*Troglochernes imitans* was coded as a troglophile by Richards (1971), based upon an assessment of the preference for guano habitat and the lack of extremely pallid coloration. But the relatively high levels of morphological modification found in *T. imitans* suggest a long divergence time from the epigean populations from which it was originally derived. The karst has been exposed above sea levels and hence habitable by terrestrial organisms since the late Miocene, but the relative age of the caves themselves is somewhat conjectural.

The three cave-dwelling species of *Troglochernes* all appear to be guanophiles. *Troglochernes imitans* inhabits dry guano produced by the Chocolate Wattled Bat *Chalinolobus morio* (Gray) within caves on the western portion of the Nullarbor Plain (Fig. 71). *Troglochernes guanophilus* resides in bat guano within Fig Tree Cave in southeastern New South Wales; the caves in the Wombeyan region accommodates five bat species including the Common Bent-Wing Bat (*Miniopterus schreibersii*) and the Eastern Horseshoe Bat (*Rhinolophus megaphyllus* Gray) (Jones et al. 1998). Rope Ladder Cave in northeastern Queensland supports large populations of *T. cruciatus* living in or near guano derived from Common Bent-Wing Bats (*Miniopterus schreibersii*) and Little Bent-Wing Bats (*M. australis*). Although *T. imitans*, *T. guanophilus*, and *T. cruciatus* are all found in guano deposits within cave ecosystems, there is some indication that they are not each others closest relatives, suggesting that they have independently developed from surface dwelling ancestors. This evidence consists of the presence of setae within the pleural membrane adjacent to the sternites in the epigean *T. novaeguineae* (Fig. 39) and the cavernicolous *T. cruciatus* (Fig. 47) suggesting that they may represent sister-species. This relationship is, however, only tenuously supported and alternative scenarios may be possible.

The presence of large populations of *Troglochernes cruciatus* within Rope Ladder Cave enables us to document intraspecific variation within what is undoubtedly a single biological

species. The meristic data, in particular, including the appendicular ratios presented above, highlight that extreme caution should be used when distinguishing species based solely upon size data when utilizing low numbers of specimens. For example, the pedipalpal femur of *T. cruciatus* was found to be 0.64–0.80 mm long and 2.40–2.98 times longer than broad in males ( $n = 30$ ) and 0.64–0.82 mm long and 2.43–2.92 times longer than broad in females ( $n = 30$ ). Similarly the pedipalpal chela (with pedicel) was 1.00–1.37 mm long and 2.66–3.00 times longer than broad in males ( $n = 30$ ), and 1.05–1.40 mm long and 2.45–2.98 times longer than broad in females ( $n = 30$ ). These ranges are greater than those cited to designate some newly described species of pseudoscorpions, and although it is not always possible to obtain large series of specimens for taxonomic research, suitable recognition should be given to alternative scenarios where allopatric outliers may not, in fact, represent distinct separate species.

#### ACKNOWLEDGMENTS

ESV wishes to thank Bronwen Scott and Phil Weinstein for their guidance and Peter Arnold (MTQ) for regular access to laboratory facilities. Chris and Ray Whitney are thanked for providing access to the caves located on their property. The following curators allowed access to the specimens examined during this study: Dr. G. Arbocco (MCSNG), Jürgen Gruber (NHMW), David Hirst and the late David Lee (SAM), John Kethley (FMNH), Graham Milledge (AM) and G.A. Samuelson (BPBM). We also wish to thank Gerry Cassis and Elizabeth Jeffery of the Australian Museum for access to the Lord Howe Island specimens examined during this study. We also thank Peter Mawson (Department of Conservation and Land Management, Perth), John Jennings (University of Adelaide), Alex Baynes (Western Australian Museum) and Norm Poulter (Western Australian Speleological Group) for providing some of the specimens used in this study, Karen Edward (Western Australian Museum) for assistance with some illustrations, and Brian Hanich (Western Australian Museum) who identified the trogid beetle from which *T. omorgus* was taken.

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*Manuscript received 28 June 2006, revised 28 December 2006.*